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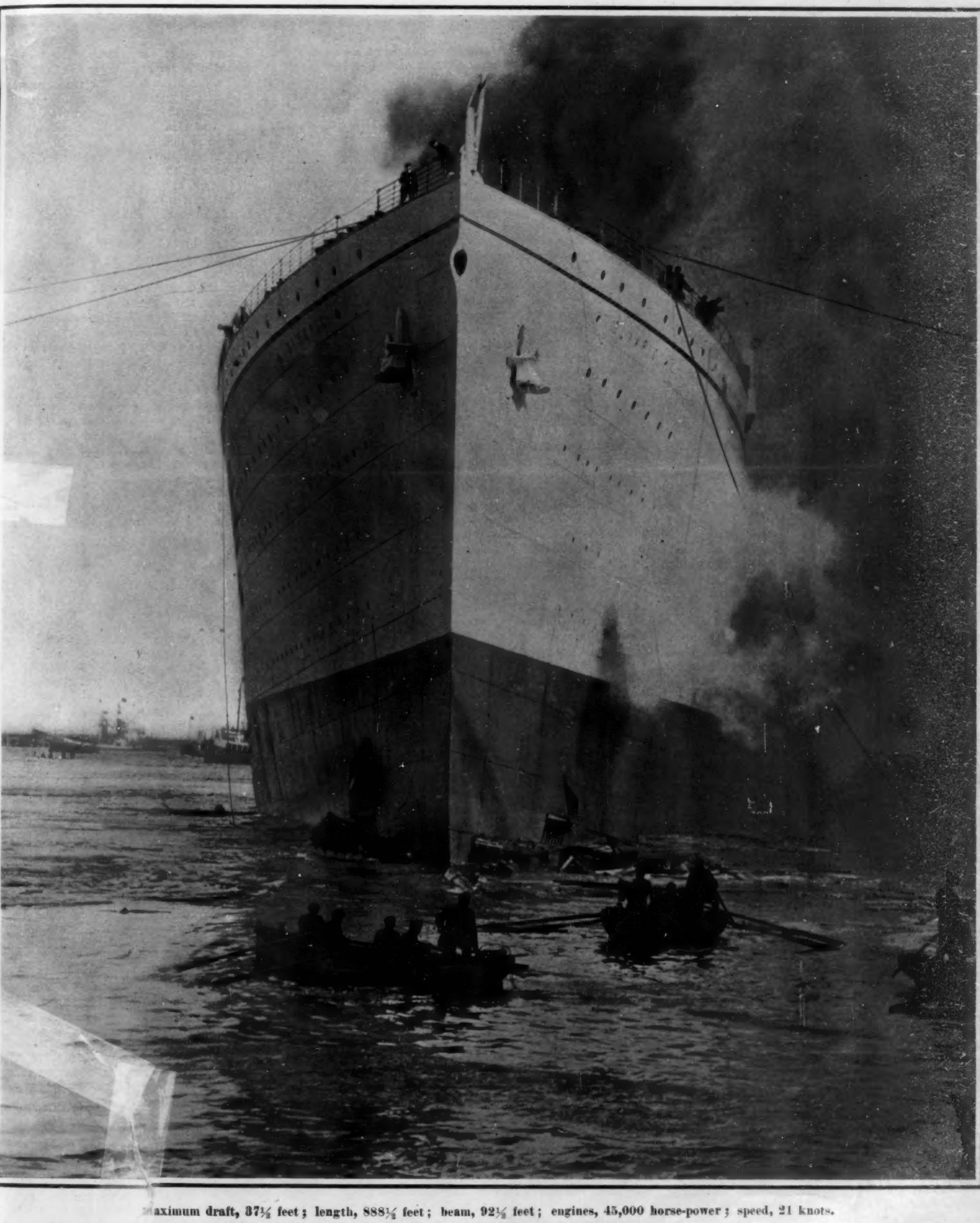

Maximum draft, 37½ feet; length, 888½ feet; beam, 92½ feet; engines, 45,000 horse-power; speed, 21 knots.

THE LAUNCH OF THE 60,000-TON "OLYMPIC," THE LARGEST SHIP IN THE WORLD.—[See page 380.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

BALLOONS AS TRAINING SCHOOLS FOR AVIATORS.

A VERY lively discussion has been aroused in aviation circles abroad by a remark made by Leblanc, winner in the very successful "Circuit de l'Est," lately held in France.

"The first essential," he is reported to have said, "for any would-be aviator is the comprehensive knowledge of his element, its normal currents and its possible treacheries. I believe my victory was due to my thorough preliminary schooling in ballooning. I should urgently advise all aviators to let their machines alone until they have first made several ascents in a balloon, as they will thus be spared much fruitless effort and lost time."

This view naturally aroused a storm of protest. It was pointed out that steamship captains were in early days required to undergo a preliminary training on a sailing ship until it was found that to spend the extra time on the steam vessel was of much greater practical value.

The editor of the German aeronautic journal, Zeitschrift für Luftschiffahrt, in commenting on this controversy, remarks that Leblanc's opinon is based on actual experience, and therefore greatly outweighs the theoretical arguments of critics, most of whom have never been either in a balloon or an aeroplane. Furthermore, he advances very weighty arguments upholding Leblanc, and maintains that remarkable achievements are to be expected only from aviators who have become familiar with their element through ballooning.

In the first place, every airman has two forms of fear to overcome—altitude fear and earth fear; and both are best conquered by familiarity with the medium in which he moves. Altitude fear is perhaps more frequent in the novice, but earth fear is based on the knowledge of serious danger, since it is quite as true in aeronautics as in navigation that proximity to the land produces perils far graver than those of deep seas or lofty altitudes.

The best possible method for the beginner to free himself of these fears, which cloud the clear use of his faculties as stage fright cripples the actor, is to go up in an ordinary round balloon conducted by a skilled pilot. He can then observe and consider quite at his ease every measure taken by the experienced airman, and can discuss with him anything that seems unusual.

On the other hand, what is the usual procedure of the aeroplanist who neglects this preparation? He takes possibly a few brief flights as a passenger in an aeroplane; then the costly machine is bought; he mounts and starts. Should he reach any considerable height quickly he becomes frightened, stops his motor suddenly, and is only too apt to crash to earth, wrecking his machine if not injuring himself. There are only too numerous records of such accidents. The second vital point in the art of flying is skillful orientation. This is insisted on by all successful aviators, and many flights have come to naught for no other reason than that the aviator lost his bearings.

It is absolutely impossible, or at least very difficult, for the aeroplanist to learn the art of orientation in his tiny and rapid machine, while to learn it in a balloon is the simplest thing in the world.

A thousand things must engage the attention of the aviator—his motor, his horizontal and vertical rudders, the currents and sudden gusts in the air, and the maintenance of equilibrium as conditioned by these.

None of these things troubles the balloonist. He can quietly study the map, and learn to differentiate various sorts of country as seen from above—a highly important matter when a landing is to be made. To distinguish dangerous forests from comparatively harmless plantations or nurseries of young trees is not easy, looking from above. Then, too, novices often mistake railroads for turnpikes.

Swampy meadows and dry ones have their slight differences of aspect, which must be noted. Hilly country, even at the moderate height of 1,200 or 1,500 feet, is distinguishable only by certain effects of light and shade which one must be taught to discern and recognize.

In short, the balloon is the best school for the aviator—or rather, a sort of training ship where the would-be navigators of the air may learn to know their element in itself, and chart the dangers of its coasts.

DIRECT SOLAR RADIATION AS AN ELEMENT OF CLIMATE.

IN the current number of the Quarterly Journal of the Royal Meteorological Society, Mr. L. W. C. Bonacina urges the importance of using freely exposed thermometers in addition to those sheltered in the usual way from direct sunshine. So far as the practical objects of meteorological and climatological observations are concerned, it certainly seems desirable to record the actual thermal conditions to which animal and plant life are subjected, and these are by no means indicated by the readings of a sheltered thermometer. For example (though Mr. Bonacina does not mention this), it is well known that at winter health resorts in the Alpine valleys, with an air temperature much below zero, invalids may sit out of doors without wraps when the sun is high, and find themselves comfortably warm. Under such circumstances the readings of a thermometer sheltered from the sun give a misleading idea of the climate. In other words, there are two factors in the thermal element of climate—air temperature and direct solar radiation—and the latter is almost generally neglected. It has been objected against the use of freely exposed thermometers that different objects are differently affected by exposure to solar or terrestrial radiation, and hence the temperature recorded by an exposed thermometer refers only to *itself*. However, although the absolute readings of such a thermometer may, for this reason, be of no value, the *relative* readings of a number of uniform instruments exposed in different parts of the world, and at different seasons, would afford a much more accurate means of comparing the thermal climatic conditions of the places and seasons in question than do the methods now in vogue. So long, says this writer, as we merely record the temperature of the air, so long will climatology be only half studied.

The following note, published by Prof. Ward, of Harvard, in the September bulletin of the American Geographical Society, may appropriately be appended to the above suggestions of his English colleague, as strikingly illustrating certain aspects of this subject:

"In Lieut. Shackleton's account of his South Polar expedition, he says it was quite a common occurrence to feel one side of the face freezing while the other was being sunburned. The Manchurian ponies would have frozen perspiration on their coats on the sheltered side, while the other side was kept dry and hot in the sun. On December 4th the men were marching stripped to their shirts, and were much sunburned, although at noon that day the temperature showed '10 degrees of frost.' These observations recall the note made by Scoresby many years ago regarding the difference between the sunny and shady sides of his vessel in the Arctic. Scoresby pointed out that the pitch bubbled in the seams of the deck in the sun, while in the shade the side of his ship was covered with ice."

TOOL STEEL DIRECTLY FROM THE ORE IN AN ELECTRIC FURNACE.

AT a recent meeting of the Canadian Mining Institute, an account was given by Dr. Alfred Stansfield of the work which Mr. J. W. Evans has performed in the production of tool steel directly from the ore in the electric furnace.

Mr. Evans's latest plant consists of a small cylindrical furnace about 18 inches high and 14 inches in diameter, having a pair of lateral electrodes and supplied with electrical current of 110 volts from a transformer of about 20 kilowatts capacity. A rheostat is used to regulate the current, which is kept down below 200 amperes. In general, it is only possible to use some 6 or 8 kilowatts in the furnace.

For smelting on this small scale the ore is crushed, and charcoal used to reduce it. Limestone is the flux. These powders are mixed, briquetted with the aid of molasses and water, and baked before smelting. Starting with a hot furnace and using between five and six kilowatts, the operation is completed within the hour, and produces about three pounds of steel. The actual quantity of ore used that enters into the product is 100 ounces; of limestone 20 ounces, charcoal 18 ounces, molasses 10 ounces, water 16 ounces. The steel is tapped from the furnace without any addition of ferro-manganese or other deoxidizer, and gives a perfectly sound and tough ingot of a good quality of tool steel. Tests have been carried out with tools cut from the ingots (not forged) with very satisfactory results.

In connection with the tests, it should be noted that in operating a small furnace, it is not practicable to take a sample of the steel from the furnace and make a quick chemical test of it, as would be done with a larger furnace, and that in consequence, the composition of the steel cannot be adjusted in the furnace, and the analysis of the resultant steel will not, in general, be as good as when working on a larger scale.

If it is admitted that a good tool steel can be made directly from the ore in the electric furnace, the most important question is whether the cost of the process will be low enough to render it commercially practicable. With this object in view, Dr. Stansfield made careful observations of the consumption of charcoal, limestone, electrical energy, and electrodes of Evans's experiments, and the results of these observations may be stated as follows:

One pound of tool steel reduced in the small electric furnace required 2.1 pounds of magnet ore, 0.4 pound of limestone, 0.4 pound of charcoal (including carbon in binding material), 0.08 pound of electrodes (Acheson graphite electrodes at 12 cents a pound), 3.0 kilowatt hours.

Most of these figures could undoubtedly be reduced in the case of a larger furnace, and it will be safe to state that a furnace making one ton or upward of steel in 24 hours would not require more than 0.35 pound of charcoal and 2 kilowatt hours per pound of steel, while the electrode losses could certainly be reduced to not more than half the above figure, or say 0.03 pound per pound of steel. Taking the electrical horse-power year at $20, the cost of 2 kilowatt hours would be 0.62 cent, and the electrodes would cost 0.36 cent, or a total cost for ore, charcoal, limestone, electric power and electrodes of about 2 cents per pound of steel. The electrode losses in the test runs were greatly increased by the practice of allowing the ends of the electrodes to dip into the slag in the furnace. If, as in the case in the larger furnaces, the electrodes do not enter the slag, but are employed merely for producing an arc, the losses should be very much less. The rate of loss must also be proportional, more or less, to the surface of the electrode, and as the surface of the electrode, or at least of the hottest part of the electrode, becomes proportionately less in larger furnaces, there is no doubt that a decided improvement will be shown in this particular.

Independent information with regard to the cost of running such a furnace on a somewhat larger scale can be obtained from the published test of the Stassano furnace in Italy made by Dr. Goldschmidt, in 1903. The test was made on quite a small furnace of about 80 kilowatts, turning out 70 pounds of mild steel in two hours, smelted directly from pure hematite ores. One pound of steel required: 1.63 pounds hematite ore, 0.20 pound limestone, 0.26 pound charcoal, 0.20 pound carbonaceous additions, 0.012 pound electrodes, 1.44 kilowatt hours.

The cost of labor, management, etc., will vary so much with the locality and particularly with the scale on which the plant is constructed that it does not seem worth while to attempt to estimate them. It may be mentioned, however, that Dr. Goldschmidt, in the report already referred to, states that in a plant of 5,000 horse-power located in Italy, producing 30 tons of steel in 24 hours, from rich hematite ores, the total cost of the steel, including ore, power, electrodes, labor, maintenance, etc., but not apparently interest or depreciation, would be very close to 1 cent per pound.

In connection with the above figures it should not be forgotten that the best tool steel is not rolled from the ingot but is drawn down under the hammer to obtain the finished bar. The cost of this process would have to be considered in determining the cost of production of the steel bars.

WIRELESS TELEGRAPHY ON BOARD DIRIGIBLE BALLOONS.

COMMANDANT FERRIE deduces from his very successful experiments, made with the French military airship "Clément-Bayard," the following recommendations for the operation of wireless telegraphy on board dirigibles. The antenna should be a wire from 300 to 650 feet long, suspended beneath the car and weighted at its lower end. Any arrangement which produces sparks or brush discharges in the open air should be avoided, on account of the danger of explosion in the case of leakage of gas in the vicinity of such discharges. The electric energy required for the production of the aerial waves may be obtained from a small alternator, of 3 or 4 horse-power, keyed on one of the propeller shafts. As the noise of the motors renders telephonic reception rather difficult, a recording receiver, operated by a coherer, may be employed, but the apparatus must then be more complicated and more delicate. As the messages received are usually less important than those which are sent from the airship, telephonic reception will suffice in most cases. Messages can be sent, without difficulty, to stations from 30 to 60 miles away, while messages can be received from powerful land stations at much greater distances. The total weight of the wireless apparatus of a dirigible balloon varies from 225 to 300 pounds, according to its power.

ELECTRICITY.

The electrical reducing furnace is gaining a firm foothold in Russia. Last spring the first furnace, with a capacity of three and a half tons, was installed at a steel works near St. Petersburg. Permission has just been granted to two other steel-producing plants to install electric furnaces. The type adopted is the Heroult.

What is said to be the highest electrical sign in the world was recently erected by the Prudential Insurance Company at Hoboken, N. J., where it can be viewed to good advantage from New York city. The principal feature of the sign is the large illustration of the rock of Gibraltar, outlined with electric lamps. The sign is erected on a tall building, the top of the rock rising 200 feet above the ground, and the sign is designed to withstand a wind pressure of 250 tons. Altogether 3,000 electric lamps are used, consuming 100 horse-power. The lighting equipment is sufficient to illuminate a large town. The principal words in the sign are written with letters ten feet high.

A new alloy of cobalt and chromium was exhibited at a meeting of the American Chemical Association in San Francisco. This alloy was discovered during the experiments of Mr. Elwood Haynes while trying to find an alloy suitable for spark plugs. The new alloy consists of 25 per cent chromium and 75 per cent cobalt. The metal is malleable and non-corrodible, and has an elastic limit of 79,000 pounds to the square inch, with a tensile strength of 96,000 pounds. It could be rendered very hard and brittle by adding other materials so that it would scratch a quartz crystal, while still other materials would make it soft and malleable, so that it could be worked cold like mild untempered steel.

We are accustomed to seeing miniature steam railways at amusement resorts, but now for the first time we are informed of a miniature electric railway, which has been installed this year at Hershey Park, Hershey, Pa. The line is about a mile long and of 22-inch gage. The train that runs over this line consists of a locomotive and four flat cars, each provided with a seating capacity of about twenty people. The locomotive contains two 10-horse-power motors, and drives the train at a speed of 20 miles per hour. The locomotive is placed at the center of the train, so that the train may be operated in either direction without making it necessary to turn the train around. The line has proved such a success, that it is planned to extend it next year to about four miles.

One of the principal drawbacks of wireless telegraphy is the fact that no very efficient call system has been invented which will serve to call an operator who is not in direct attendance upon the instruments. According to press dispatches, when the Wellman airship sighted the steamship "Trent," it was impossible to call the vessel by means of wireless telegraphy because the operator was not at his post. Instead of that, light signals had to be used, and it was not until the "Trent" had been notified by means of signal lamps that the "America" was equipped with wireless apparatus, that wireless communication could be established. Had there been a fog at the time, wireless calls for help on the part of the crippled airship would have received no response.

Despite the fact that the single-phase system of the New York, New Haven and Hartford Railroad has been severely criticised, that road has thought so much of this type of electrification that it is about to employ it in the Hoosac tunnel. The current will be used at 11,000 volts, and will be obtained from a power station with the capacity of 6,000 kilowatts. All trains, whether passenger or freight, will be propelled by electricity through the tunnel. In addition to this section, the line running from the subway at 180th Street to North White Plains and New Rochelle will also be electrified with single-phase equipment. There are three other electrification projects of this railroad now being considered, namely, the branch from New Rochelle to Morrisania, the extension of the present electric zone to New Haven, and the electrification of the Boston terminal.

A most ambitious electric generating and transmission system is soon to be undertaken on the Pacific coast of Mexico. Three large hydro-electric plants are to be built, having a combined capacity of three hundred thousand horse-power, and according to present plans 1,200 miles of transmission lines will be built, covering most of the Pacific coast of Mexicc, or a territory about seven hundred miles long. One of these plants will be situated on the Mayo River, across which a dam 170 feet high and 260 feet long will be built. This will form a reservoir with a capacity of 10 billion cubic feet of water. Another dam, 223 feet high and 708 feet long, will be run across the Humaya River, forming a reservoir of 11 billion cubic feet, while the third dam, 215 feet high and 145 feet long, will be stretched across the Santiago River, and will furnish a reservoir of 9 billion cubic feet capacity.

AERONAUTICS.

Mr. Robert Loraine on his aeroplane recently succeeded in maintaining communication with a ground station for a distance of over a mile. The experiments are to be continued by Mr. Thorne-Baker, the inventor of the wireless apparatus.

After having flown approximately 140 miles as the crow flies, in an attempt to reach Brussels from Paris in an aeroplane, M. Mathieu landed at Braine-le-Comte on October 28th, and owing to the darkness was unable to proceed further. He therefore failed of the accomplishment of his purpose by only about twenty miles.

The principle of wing warping constitutes one of the great claims in the Wright patent, and, moreover, the Wright brothers regard machines fitted with any form of horizontal balancers as infringements of their claim. The Neale biplane is a machine that certainly does embody a method of control that constitutes an interesting development in aeroplane construction. This machine is steered and balanced by movable vertical planes hinged to the outermost forward struts of the main planes, and these vertical planes, in conjunction with the fore and aft elevators, constitute the sole controlling organs.

The management of the International Aviation Tournament at Belmont Park took out insurance against the possibility of injuring the spectators, with Lloyds of London, to the amount of $500,000 at the rate of $2,500. Lloyds assumed all liability for the period of the meeting. The risk, however, covered spectators only. Policies had also been taken out with a New Jersey insurance company on the aeroplanes to be used at the meeting, covering risks from the point of shipment, during transportation, and while they were in the shelter houses at Belmont Park. Numerous policies covering the liability of employers for accidents to employees were taken out for the meeting, most of which policies are for $10,000 and a few for $5,000. They included the workmen's compensation indorsement, as well as the ordinary insurance. Aeroplane sheds and other temporary structures on the Park grounds were insured for $25,000.

The most severe test to which the Italian military airships have been subjected was commenced on the 29th of September, when "No. 2" left Bracciano, near Rome, on a 230-mile journey to Venice. The first stop was at Arezzo, about 90 miles from the starting point, for propeller repairs. Late in the day the airship once more ascended and crossed the Apennines above the Via Magio Pass. To accomplish this an altitude of 6,500 feet had to be attained, and this meant releasing a large quantity of ballast and fuel. A descent was necessary at midday on Friday at St. Arcangelo de Romagna, where the airship was anchored for the rest of the day. On Saturday morning the dirigible was once more on its way, but toward evening a thick fog compelled a descent at Porto Caleri at the mouth of the Po. On Sunday morning a fresh start was made, and within an hour the airship was cruising over Venice, shortly afterward being safely berthed in her shed. The airship is the latest of the military dirigibles, and is slightly larger than the two which have preceded it, the envelope being 260 feet in length.

There are three points at the present moment worrying the French designers, the presence of a front elevator, the shape of the tail, and the method of obtaining lateral stability, says a writer in Flight. The front elevator has disappeared from every biplane of note, save the Farman and the Sommer. Mr. Farman designed and built a biplane without a forward elevator many months ago, but after many experiments has reverted to his former type. The front plane adds to the discomfort of flying, and increases head resistance greatly. As to the tail, most constructors have adopted the monoplane type again, with the exception of Mr. Farman, who, after trying many different types, has finally returned to the biplane form. There is an increasing tendency to fit two rudders side by side, this giving a greater grip on the air, and consequently greater ease in making turns. Instances of this double rudder can be found on the Farman, Goupy, Sommer, and S.A.F.A. biplanes, and on the Nieuport monoplane. M. Voisin places the rudder under the tail plane, and M. Tellier over it. The majority divide the rudder into two parts, above and below the plane. The question of lateral stability has naturally settled itself into the use either of wing flexing or ailerons. Wing flexing, while infinitely the better method, has the serious disadvantage of weakening, by constant bending, the spars of the wings. Ailerons, when fixed to the trailing edge of the wing, exercise considerable drag on the machine when in operation if used the least degree too strongly, so that frequently instead of righting the machine the effect is to bring it to the ground. And as for ailerons fixed between the two main planes, they are the least effective of all in practice, and now very few makers employ them. Such ailerons act simply as a brake, and only restore stability very slowly and then only at high speeds.

SCIENCE.

Gregor Mendel, who gave the world the law of heredity that bears his name, has had a monument erected to him at Brünn, where he died in 1884 at the age of 62.

Prof. L. Pallazzo has published a paper on his magnetic survey of Sardinia. The eastern side of the island appears to be normal, but the western shows great abnormalities, which are not due to surface rocks.

Prof. Puiseux, of the Paris Observatory, examines in the Comptes Rendus the evidence of the large-scale pictures of the Paris Lunar Atlas for determining the mode of origin of the craters and angular crevasses on the moon's surface. The peculiar arrangement of many of the craters appears to preclude the possibility of their being due to splash effects from an ancient meteoric bombardment, and it appears more likely that they are due to local causes. Many of the fissures, once thought to be straight, are seen on these large-scale photographs to be stepped, resembling the cracks formed in walls built up of regularly shaped blocks.

Accurate chemical analyses of rocks and of the component minerals of rocks, have become increasingly important in the modern development of petrology. The discovery of new rock types is continually providing fresh material, and demonstrating that the older rock analyses no longer suffice for the requirements of the present day. In this work a leading part has been taken by American chemists, and particularly those of the United States Geological Survey. In the last thirteen years, four bulletins have been issued, giving complete analyses of many American rocks, conducted in the laboratory at Washington.

The selective elimination of organs is discussed in a recent article in Science by Dr. J. Arthur Harris. He points out the necessity of spending much time in the potting shed and the breeding pen, of being strenuous in the use of the eyepiece micrometer, the calipers, the color scale, the statistical tables; of believing that ten times the conventional number of observations are desirable; of repeating his experiments and making new series measurements, and of believing that a few gourds full of statistical information, with tabulated data from which they may be verified, are more to be desired than an artesian well of personal opinion based on non-quantitative observations.

Parallax investigations on thirty-five selective stars by Frederic L. Chase, Mason F. Smith, and William L. Elkin are contained in the second volume, second part, of the Transactions of the Astronomical Observatory of Yale University, recently published. Of the stars there discussed, two-thirds have already been the subject of inquiry at Yale and elsewhere, but on various grounds the results have been regarded with a degree of suspicion that made a repetition of the measures desirable. The grand result of the work at Yale, which has occupied the three observers for some years, is to assign a parallax to two hundred stars with an accuracy that has probably not been exceeded elsewhere.

"Physical Science in the Time of Nero" is the title of a recently issued book, which is a translation of the "Quæstiones Naturales" of Seneca. Considering the state of physical science in that antique age, Seneca was an observer of no mean ability. He observed the magnifying power of a spherical water lens, recognized the three kinds of movement associated with earthquakes, dimly perceived the doctrine of the conservation of matter, wrote on the effect of forest denudation, on the amount of rainfall, on the character of floods, etc. To be sure, he did maintain that the earth was fixed and located within a revolving starry dome. That does not seriously mar the value of observations made at a time when observation itself was frowned upon in favor of sheer philosophical speculation.

The perfilograph is an ingenious instrument for recording graphically the undulations of the bottom of a channel in depths to about six or seven fathoms. It is the invention of Augustus Mercau, an Argentine engineer, by whom a paper was read at Buenos Ayres before the Naval Section at the recent meeting of the International American Scientific Congress. A heavy weight of from 150 to 200 pounds is slowly dragged along the bottom by a wire rope attached to the stern of a steam launch. As the depth changes, the inclination of the wire varies. The sine of the angle made by the wire with the horizontal plane is registered graphically in parallel ordinates on a roll of paper which is slowly unwound by means of clockwork at a rate proportionate to that of the vessel. The lengths of the ordinates, being proportional to the sines of the varying angles, represent the undulations of the bottom referred to in the horizontal plane, and are registered on a convenient scale on the paper by means of a system of levers.

THE MANUFACTURE OF WOOD PULP

AN AMERICAN INDUSTRY INTRODUCED INTO FRANCE

BY JACQUES BOYER

In view of the continual and rapid increase in the consumption of paper throughout the world, it may well be asked if the supply of paper stock will not one day be exhausted, notwithstanding the substitution of wood pulp for rags.

The most important improvement in the manufacture of wood pulp is the sulphite process patented in America in 1866 by B. C. Thilgmann. But this process, in which the wood is boiled with a solution of alkaline sulphites, did not become really practical until after the researches which were prosecuted, independently, by Eckmann in Sweden, Mitscherlich in Germany, and Kellner in Austria. Kellner discovered accidentally, in 1872, that cellulose could be obtained by boiling wood with sodium bisulphite, for which he afterward substituted the bisulphites of lime and magnesia.

In this field of industry, as in many others, France has allowed herself to be surpassed by other countries, so that she was compelled, last year, to import 286,000 tons of wood pulp. There are only 27 wood pulp factories in France. The first place, in this industry, is occupied by the United States, with an annual production of 500,000 tons of wood pulp, none of which is exported. Germany comes next, with an annual production of about 250,000 tons. Wood pulp is made also in Finland, Denmark, Spain, Canada, and Japan. A large part of the wood pulp consumed in Europe is furnished by the 88 pulp mills of Sweden and the 63 mills of Norway, which annually produce 324,000 tons of pulp, of which 224,000 tons are exported. The wood of the spruce is used for making common paper, poplar and willow for the better grades.

The valley of the Seine is capable of supplying many pulp mills with poplar and willow, for these trees are not fastidious in regard to soil and they could be planted on large areas of uncultivated land which, with little care, would soon become productive.

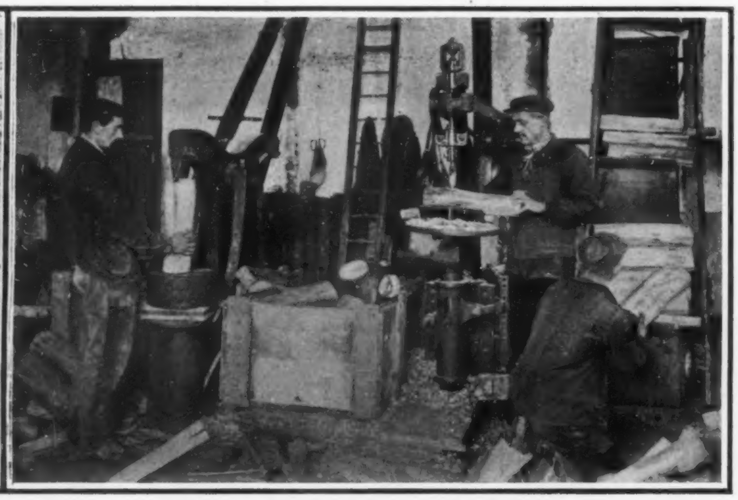
While the manufacture of wood pulp has begun to develop, timidly, in France, the accompanying photographs, taken in the Prioux establishment at Léry, will illustrate the successive stages of this American industry which has been transplanted to France. The wood arrives at the factory in the form of logs, about five feet long. Immediately upon arrival, the logs are piled in great basins 50 feet deep, 160 feet long, and 100 feet wide, where they are held down by heavy chains and completely immersed in water, in order to prevent them from splitting and to facilitate the subsequent operations. When the logs are removed from the water, they are deprived of their bark, usually by hand, and are cut by circular saws into sections from 16 to 40 inches long, for distribution among the machines of various dimensions, which split each section into three or four parts, according to its diameter. The splitting machine (shown at the left of one of the illustrations) consists of a T-shaped piece of cast iron, each arm of which carries a sharp wedge, with its edge downward. This piece oscillates about its foot and, as each wedge descends, it splits the log which a workman holds upright beneath it on a cast-iron bedplate. The same photograph also shows the boring machine by which knots are removed. If this precaution is not taken, the knots, after passing the grinding machine, appear in the pulp as red spots, which are known in the trade as "pepper." The billets thus prepared are carried by an elevator to the grinding machines or pulp mills. These are grindstones, about four feet in diameter, rotating from 180 to 250 times per minute. The billets are pressed against the rim of the stone by hydraulic pistons. Some of these machines can grind 1,000 cubic feet, equivalent to the wood of five or six poplar trees, from 65.6 to 82 feet high, in 24 hours, and require several hundred horsepower for their operation.

A jet of water directed upon the revolving stone carries the ground pulp to the horizontal and vertical screens, which remove the coarse fibers and chips. These machines consist essentially of oscillating sieves, with holes varying from 1/30 to 1/60 inch in diameter, according to the grade of paper for which the pulp is to be used. The mixture of pulp and water then flows through pipes to centrifugal separators, which remove part of the water. The condensed mixture flows on to large receiving vats, whence it is pumped into the pipes which supply the refiners. In these machines the pulp is ground again between two millstones, the upper one of which revolves while the lower one is stationary. The pulp enters through a central hole in the upper stone and is expelled by centrifugal force at the circumference. From the interior of the iron case which surrounds the stones the twice-ground pulp flows to the grading machines through very long wooden conduits, having at the bottom transverse cleats, which retain the grit from the millstones and the coarse particles that have escaped the second grinding.

The grading machine is a conical drum covered with wire cloth, which rotates slowly on its horizontal axis. The pulp, entering the small end of the drum, is divided into a fine-grained portion, which passes through the wire cloth, and a coarse-grained portion which is discharged at the large end of the drum. Each of these portions is pressed separately.

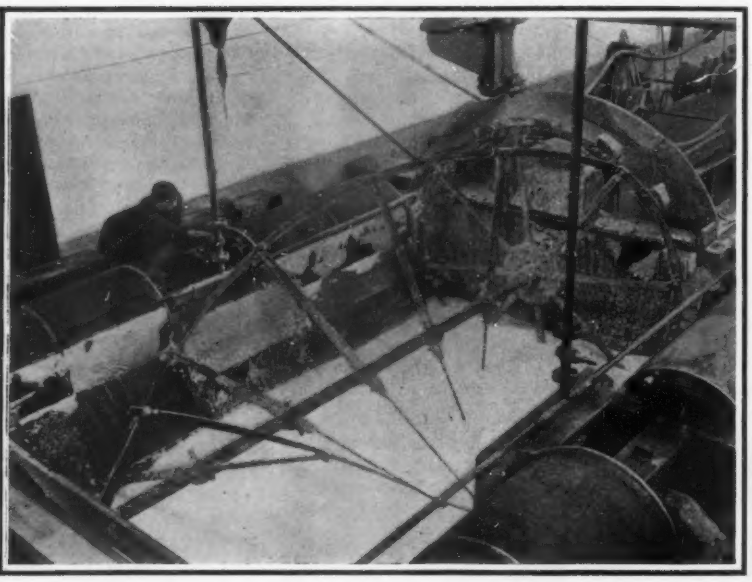
The manufacture of wood pulp is completed by the pulp press. The wet pulp, on arriving at the press, is received on a moving endless band of wire cloth. In the first stage of the journey, part of the water drains off through the wire cloth under the action of gravity. The pulp is then carried over a series of suction boxes, which continue the desiccation. At the end of its course the pulp passes between two press rolls, from which it emerges in the form of separate sheets of soft, wet cardboard. These sheets are carried by an endless band of felt to a second

Removing the bark and sawing the logs.



Splitting the logs and boring out knots.

Grinding machines or pulp mills.



Receiving vat.

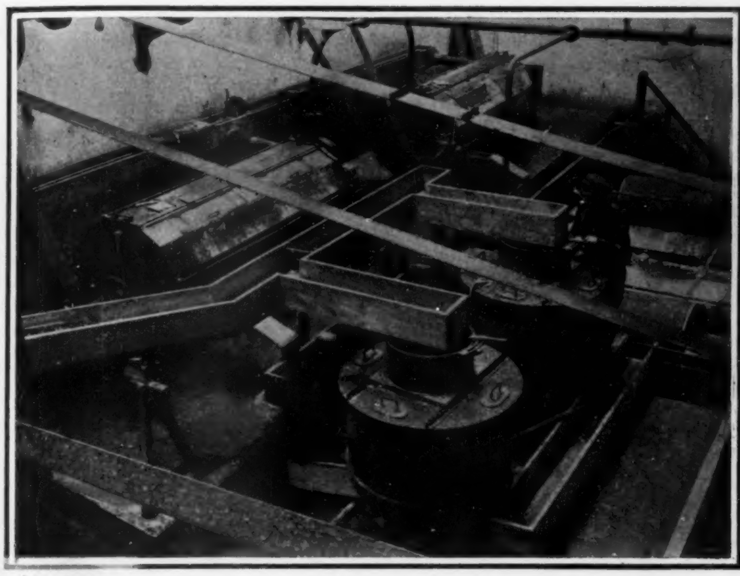
THE MANUFACTURE OF WOOD PULP.

pair of rolls. The compressed sheets, after drying, resemble ordinary cardboard.

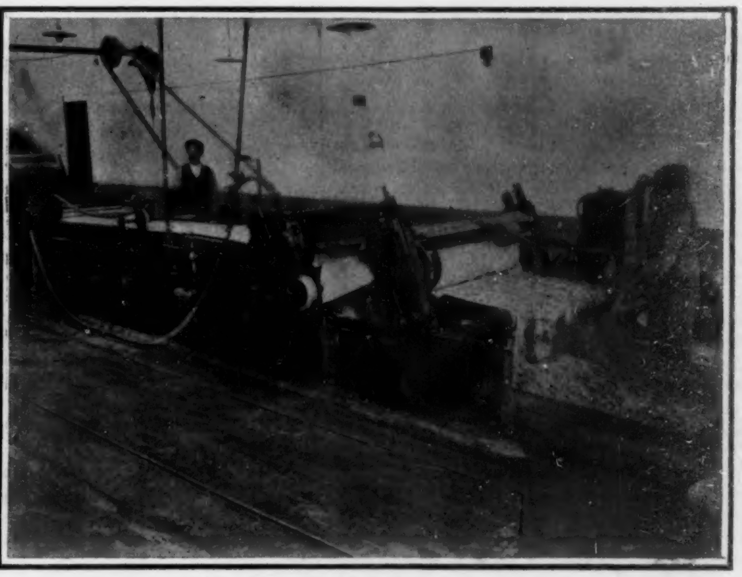
A factory for use in the mechanical production of wood pulp is not complete without a save-all, for the recovery of the fine particles which have been carried away by the residual water from the other machines. The save-all is a large wooden vessel, in which rotates a drum covered with felt. The water filters through the felt, which retains the suspended particles and gradually becomes covered with a layer of pulp. When this layer has attained a sufficient thickness, it is detached from the felt and pressed between a metal and a felt-covered roller, to the former of which it adheres until it is detached by a blade, technically called the "doctor."

In the chemical or sulphite process of making wood pulp, spruce and other resinous woods are used. The logs, after the bark has been removed, are cleaned and sawn into thin slices in order to facilitate the entrance of the chemical agents. The wood is then heated, under pressure, with a solution of bisulphite of lime, which dissolves the resinous matter. The digester is of great size and is lined with lead or some other material which is not affected by weak acids. It may be rotary or stationary. In the latter case it is lined with walls of glazed bricks, cemented with especial care, manholes being left for charging, emptying, and cleaning. After the charge of wood and bisulphite solution has been introduced, the boiler is closed and the contents are heated by injecting steam under pressure. The operation is soon completed and the resultant pulp needs only to be mixed with water, washed, purified, and dried for storage and shipment. Sometimes it is bleached with chloride of lime. The bisulphide of lime employed in the digesting process is prepared, easily and cheaply, by dissolving limestone in a solution of sulphurous acid. Bisulphite pulp can be kept a long time without deterioration and can be converted directly into paper.

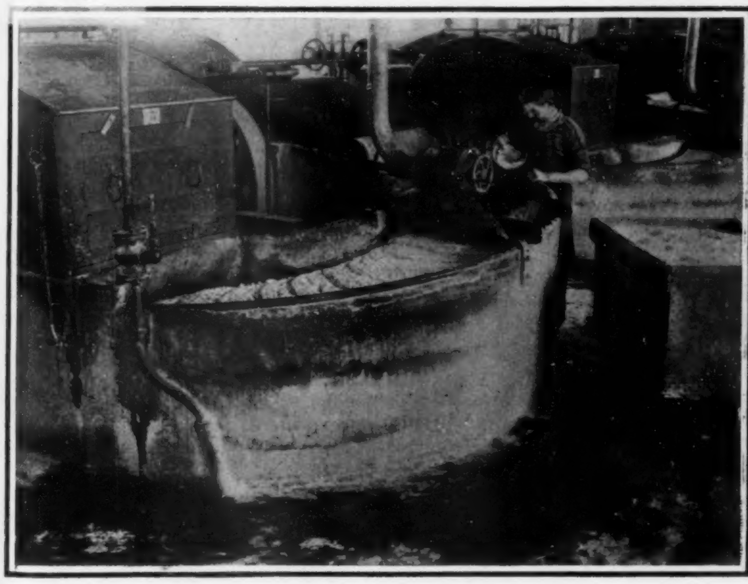
One of the troubles of textile manufacturers, spinners, and weavers, is that most fibers become charged with frictional electricity, with the result that there is a considerable amount of repulsion, making the process of manufacture very difficult. This, states the Electrical Engineer, is partly got over by humidifying the air, though this is only indifferently successful with silk, wool, and certain vegetable fibers, such, for instance, as China grass or ramie. To overcome this, the Chapman electric neutralizer has been introduced. The apparatus consists of a special form of transformer, transmitting alternating current through an insulated wire to an inductor. The inductor is a slotted steel tube of about 1½ inches in outside diameter. In the slots are porcelain blocks holding the metal active parts. These are connected to a wire inside the tube. The inductor is placed in some convenient place of a machine where the material to be neutralized—fiber or yarn—passes at a distance of between 1 inch and 3 inches. Connection between the insulated wire and the inductor is made by means of a plug. The attractive force of the alternating current thus distributed at once neutralizes the material, even when it is traveling at a rate of 1,000 feet per minute, and in this way smooth working is obtained.



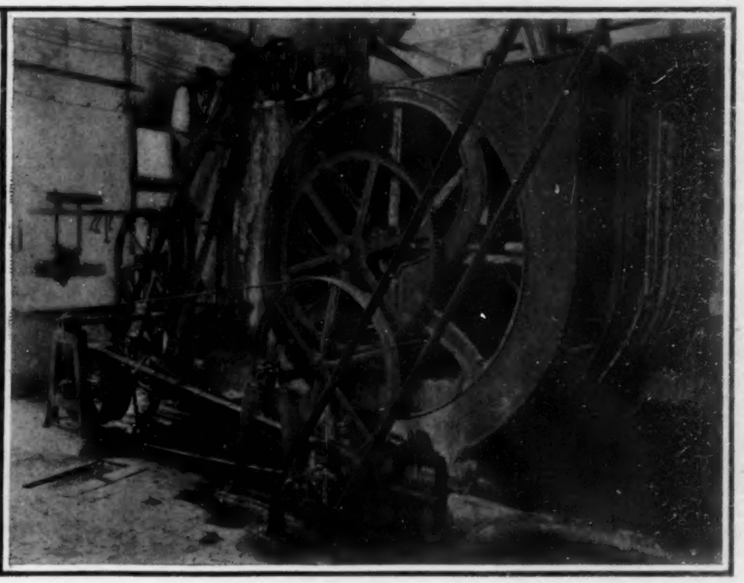
Horizontal and vertical screens.



The pulp press.



Grinding stones for wood pulp.



The "save-all."

THE MANUFACTURE OF WOOD PULP.

Was Bernard Palissy an Impostor?

The biographers of Bernard Palissy (1510-1589) have painted in glowing colors the indomitable energy of this man who, abandoned by all his friends, burned his house and furniture in his furnaces and subjected his wife and children to the most cruel privations, in order to snatch from fire the secret of enameled pottery and to extort from nature the history of past geological ages.

The story is dramatic, but, unfortunately, it is based entirely upon Palissy's own assertions. M. Louis Franchet, who has made a special study of medieval enameled pottery, has recently subjected Palissy's statements to critical examination, and has apparently proved that the famous potter was neither an inventor nor the founder of a school, but was simply a pretentious braggart and an unscrupulous plagiarist.

Was Palissy the creator of the art of enameling pottery in France? In the first place, is it true that his mission was revealed to him, as by a lightning flash, in 1555, by the sight of a marvelously beautiful cup? He betrays himself in his writings, which show that he began work in pottery more than ten years before that date. Furthermore, the enameled pottery which Palissy claimed to have invented had been made in all parts of France for four centuries before his birth. We now possess the certainty that large quantities of enameled pottery, specimens of which can be seen in most museums, adorned many French chateaux and churches in the middle ages. Careful study of Palissy's faiences reveals the startling fact that many of his decorations in relief are simply casts, taken from ornamental vessels of tin, which were extensively used in his time.

Cuvier and other writers have given Palissy the high-sounding title of "the founder of geology." Palissy, indeed, tells us of the profound sagacity by which he discovered that fossil shells were the remains of once living shell-fish. He tells us that, in walking from Marennes to La Rochelle, he saw many freshly quarried stones which were full of shells, and that he pursued his journey with his head bowed so that nothing should distract his thoughts from the solution of this mystery. But Palissy has forgotten to add that the tribulations of his spirit ceased when he had read Cardan's writings concerning fossils.

In marine fossils found on dry land, Cardan saw evidence that the land had been submerged at a very remote epoch; but Palissy, wishing to appear more ingenious than the author whom he plagiarized, conceived the absurd idea that such fossils were remains of animals which had been eaten on the spot by human beings!

M. Duhem has shown that Cardan's views concerning fossils were not original, but were borrowed from Leonardo da Vinci, that amazing genius who, in addition to his other claims to our admiration, well deserves to be regarded as the real founder of geology.—Translated for the Scientific American from Cosmos.

New Christmas Tree Lamps.

The electrically lighted Christmas tree is now a feature of the holidays in many homes. This year some new kinds of miniature incandescent lamps are available, which should make the electrically lighted Christmas tree more artistic and beautiful than ever before. The bulbs of the new lamps, instead of being mere "pocket editions" of the ordinary incandescent bulb, are shaped and colored to resemble fruit, flowers, birds, and animals. Commercially, they are classed under five heads, as follows:

1. Small fruit, including apple, blackberry, gooseberry, lemon, mulberry, orange, pear, peach, and strawberry. 2. Large fruit, including apple, orange, peach, and pear. 3. Nuts, including acorn, pine cone, and walnut. 4. Flowers, including lily, rose, and thistle. 5. Animals, including canary, clown, dog, owl, snow man, and Santa Claus.

It is doubtless somewhat embarrassing to Santa Claus to be classed as an "animal," but there seems to be no alternative.

The blubs are colored by hand with water-proof paints by professional toy-makers. The realistic effect is considerably heightened when the lamps are lighted.

As far as the base and filaments are concerned, the new miniature incandescents are just like the conventional decorative lamps used in the past (and still available) for Christmas tree illumination. They have ⅝-inch miniature screw bases, and are designed to be burned eight in series on circuits of from 100 to 120 volts. By using a bell-ringing transformer they may be burned in multiple, but while the arrangement has the advantage that the burn-out of a single lamp does not extinguish others, the cost of equipment is considerably greater than with the series system. The bulbs contain one candle-power filaments, but the coloring material absorbs a large percentage of the light and softens the remainder by diffusion.

Whether festooned on the Christmas tree or used to decorate the room or table, these fascinating little lamps add a touch of light and color that harmonizes with the Yuletide spirit.

Chavez on His Height Record.

In an interview with a newspaper man shortly after he made his remarkable height record of 2,680 meters (September 8th at Issy), Chavez is quoted as having said: "It was fearfully cold up there. Fortunately, I had on a winter suit, which I had made especially for my Simplon trip. For that reason I did not suffer as much from the cold as might otherwise have been the case. I tried for this record height largely as a sort of preliminary training for the Simplon trip. On account of the hazy weather, I made use of a peculiarly formed cloud for a goal. In that way, I managed to guide myself to a certain extent. Shortly after I left the ground the wind began to play all its tricks. The changing air currents gave me all manner of difficulty. At a height of about 500 meters the situation was particularly bad. It was not until I got up rather high that the atmosphere became calmer. I soon lost sight of the Eiffel Tower altogether, and I thought that I was probably near Versailles. I would gladly have tried to fly over Paris, but my motor did not seem to be working regularly. At a height of about 2,000 meters it missed fire several times. In this bitter cold, the glass gage of the oil tank was covered with frost as soon as the sun was behind me, but as soon as the sun's rays struck it again, the frost melted off.

"Without the cloud to which I have already referred, I would not have been able to guide myself. Below me, there was a vast sea of fog. Only here and there did I catch sight of the earth through a rift in the clouds.

"At a height of 2,000 meters, an aviator has not much time to look about him and marvel at the sights which greet him. He has his hands full in maintaining himself on an even keel, which is all the more difficult the higher the altitude. The rays of the sun, which played among the propellers, bothered me a good deal. I could see the horizon only as a trembling line. It seemed to flicker, like the moving pictures of a cinematograph, so that the eyes were not a little irritated. I did not experience that difficulty in breathing about which many aviators complain who have tried to climb to great heights."

A shock arrester on a dredge operating near Hammonton, Cal., is used to diminish the strain on the hull of the boat transmitted through the spuds when the bucket lines are suddenly stopped by encountering a boulder. The device, as described by the Engineering and Mining Journal, consists of springs from standard car trucks placed against a buffer fixed outside or astern of the spud. The springs, which are double coils 7½ inches long, are bolted through the spud casing and similar cross timbers on the opposite side of the spud. When a heavy shock comes upon the spud, instead of being transmitted directly to the frame of the boat it is taken up in a large measure by the springs, the buffer being held in place by the rods that connect the springs to the main spud casing.

Official Meteorological Summary, New York, N. Y., October, 1910.

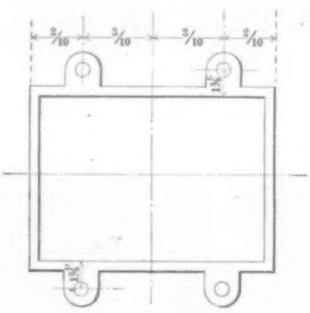
Atmospheric pressure: Highest, 30.42; lowest, 29.52; mean, 30.01. Temperature: Highest, 83; date, 6th; lowest, 32; date, 30th; mean of warmest day, 76; date, 6th; coolest day, 38; date, 30th; mean of maximum for the month, 65.7; mean of minimum, 50.7; absolute mean, 58.1; normal, 55.6; average daily excess compared with mean of 40 years, 2.5. Warmest mean temperature of October, 61, in 1900; coldest mean, 50, in 1876. Absolute maximum and minimum for October for 40 years, 88 and 31. Average daily excess since January 1st, 2.5. Precipitation: 3.79; greatest in 24 hours, 3.04; date, 20th. Average for October for 40 years, 3.71. Accumulated deficiency since January 1st, 8.33. Greatest precipitation, 11.55, in 1903; least, 0.58, in 1879. Wind: Prevailing direction, northwest; total movement, 9,421 miles; average hourly velocity, 12.7 miles; maximum velocity, 50 miles an hour. Weather: Clear days, 14; partly cloudy, 9; cloudy, 8; on which 0.01 or more of precipitation occurred, 5. Relative humidity, mean of 8 A. M. and 8 P. M., 67.1. Frosts: Light, 13th; heavy, 29th; killing, 30th.

FOUNDRY FLASKS—UNITED STATES STANDARD.

On account of the variation of castings for flasks, all measurements as to list sizes must be made on the inside at the parting line, and the sizes listed at the full half-inch found next below the actual measurement. (To illustrate: Should the actual width be 12⅝ inches and the length say, 14 3-16 inches, it must be listed as 12½ by 14.)

The location of the pin-holes is not to be made from the actual measurement of the flask, but from the list size as same is provided for above.

In locating the pin-holes, the measurements must be made from lines drawn at a right angle through the



FOUNDRY FLASKS.

actual center of the flask, and the distance apart along the sides of the flask from center to center of the pin-holes must be exactly three-fifths (3/5) of the list length (or 3/10 from the actual center line). The distance apart across the flask must be exactly three inches (3 inches) greater than the list width, or one and a half inches more than from center line to center of pin-holes.

For flasks of less than 500 square inches of surface measure the pin-holes must be exactly a half inch (½ inch) in diameter.

The above applies to flasks of all depths.

A $15,000 Prize for Aeroplanes.

Mr. Edwin Gould has offered, through the columns of the Scientific American, the sum of $15,000, which is to be awarded for the construction of a heavier-than-air flying machine, equipped with more than one motor and propeller.

The conditions governing Mr. Gould's offer were published in the Scientific American, issue of October 29th.

The Gas-supported Airship.

By Carl Dienstbach.

It has been rather unfortunate that the series of accidents sustained by the rigid Zeppelins and the recent rapid development of the aeroplane have diverted public attention from the dirigible balloon, the first successful air craft of which the world knew anything—unfortunate because the public will be blinded to the real merits of the dirigible.

Aeroplanes of many new types are increasing in number. For the most part, they are tried out in private, which is perfectly possible because of their small size. If they are wrecked during a more or less private test, the injury can be repaired, or the entire machine rebuilt, and the general public knows but little of the damage sustained. It is impossible to try out a dirigible of the size of a Zeppelin or a Lebaudy with any such secrecy. Its failure or success is promptly chronicled in the daily press, and the general public forms its judgment accordingly on very little technical foundation.

It is now generally conceded that small dirigibles of the type constructed by Santos-Dumont some ten years ago are comparatively useless. They are too frail, too curtailed in their radius of action, too sensitive to weather conditions, and too small. A really useful dirigible must have a displacement of at least 2,000 cubic meters, a minimum radius of action of 140 miles, and a minimum speed of 24 miles an hour. Its construction must be so staunch that it must necessarily be expensive. Principally because of the expensive construction, such large craft have hitherto been built only by governments, or by such wealthy men as the Lebaudys, M. Deutsch de la Meurthe, Dr. Goldsmith, or by such large business firms as Siemens-Schuckert, the Clement-Bayard Company, the Lanz Company, and the corporations which built the Zeppelins and the Parsevals. Newspapers such as the Chicago Record-Herald and the English Morning Post have likewise been able to construct fairly large craft, either through popular subscription, or through their own private means.

The present vogue of the aeroplane was not unexpected by the very men who have devoted so much time and energy to the improvement of the gas-supported airship. But these improvers of a craft which now seems to have fallen into disrepute have ever realized that there will always be a place for the dirigible, as there will always be a place for the aeroplane. Neither type is quite able to perform all the functions of the other. It is fortunate that the great European powers have pledged themselves to the development of the airship to a point where its virtues cannot fail to convince even the most skeptical. It is inconceivable that engineers and intelligent business men, who compose the great stock company formed by Zeppelin, are not convinced of the merits of the rigid airships advocated by Count von Zeppelin. Even the French, who have perhaps done more than any other people to bring the heavier-than-air flying machine to a commercial stage, have recognized the necessity of building dirigibles. It is true that Count von Zeppelin has met with a series of accidents which must be discouraging to his adherents, but on the other hand we must not forget the performances of such pleasure airships as the "Ville de Lucerne," the "Ville de Pau," the "Ville de Nancy," and others of the Compagnie Générale Transaërienne. Nor must we overlook the efficiency, for military purposes at least, of such craft as the "Clement-Bayard II.," recently described in these columns, the "Colonel Renard," and the "Liberté." Vessels such as these have evidenced their ability for thorough reconnoitering when manned by a trained crew, and when equipped with wireless apparatus.

It seems rather strange that the popular fancy has not yet seen the luxurious side of airship touring, as compared with the strain of heavier-than-air travel. There is a fascination about airship travel possessed not even by sea voyages. At the lofty elevation at which a Zeppelin plows the air, the people and houses shrink to one-third of their apparent size when viewed from the top of our tallest buildings. If a passenger on the Zeppelin "Deutschland" turns away from this view to contemplate his immediate surroundings, he will find himself in the midst of a gathering as refined as that which he will find on any steamer afloat. He is seated in a comfortable arm chair, with a snug little table in front of him, on which an attentive waiter places tempting dishes. He breathes the sweetest of dustless air. He feels no vibration. Only the slightest swaying gives him the sensation of floating in space. If people in general knew more of the wonderful emotions aroused by a journey in the Zeppelin, especially in America, where Wellman's balloon was the only true airship ever seen, it is possible that we would see not only the many aeroplanes which now skim the air, but vessels as luxurious as those constructed by Count von Zeppelin.

In the "Clement-Bayard II." the French have developed a craft that is particularly well adapted for military service. In Germany, however, the airship problem has been studied perhaps more thoroughly, and the types created are a surer indication of what the future holds forth. In other countries (Italy, England, and Belgium) we find types similar to those which the French have made popular, but with interesting variations and improvements.

The German types are superior on the whole. Of these, the smallest is perhaps the Parseval sporting type, designed to take the place of the spherical balloon now used by dozens of aero clubs in Europe. This Parseval is particularly interesting, because its constructors have profited by the rise of the aeroplane. The Parseval is built with a displacement equal to that of the average fair-sized club balloon, namely, 1,200 to 1,400 cubic meters. It has the same carrying capacity as these. It can be inflated and handled, landed, anchored, deflated, and packed up with the

(Continued on page 388.)

Correspondence.

BIRDS AND INSECT PESTS.

To the Editor of the Scientific American:

For years it has been the fad of certain enthusiasts to state that if it were not for birds the vegetation of the earth would be wholly destroyed. Recently dozens of Sunday papers have teemed with articles from callow game wardens or more mature swivel-chair entomologists about the "beautiful balance in nature between birds and insects." In your issue of August 27th a writer drops into a similar strain, and quotes another about "the beautiful harmony of nature" being "destroyed" and injurious insects being on the increase because of this. As I have always regarded the American as the embodiment of facts and not fads, I beg a bit of space for protest.

There can be no doubt about the increase of certain insects, but that birds have little to do with it in a general way may be easily shown to any thinking person. Insects increase when and where the conditions of sustenance and favorable environment for breeding avail. That birds consume some of them is not denied, but there are thousands of them which the beak cannot reach, and, if it could, it could not affect them, if it prevailed in pristine abundance. Thus no amount of birds have ever lessened appreciatively the inroads of the army worm, the chinch bug, the Hessian fly, the greenbug, and the swarms of grasshoppers, and so on. Quails may eat a few chinch bugs and a turkey may pick off a few Colorado beetles, but we roast potatoes by the virtues of Paris green, London purple and Bordeaux mixture; and Prof. Snow saved the entire West from chinch bugs with poisonous fungi—slaying a forty-acre field full in a night.

The work of the bird is much over-rated. Because the "stomach content" student finds the crop full of insects, he infers that great ravage is being made by the feather. With my yard full of birds for years I have never been able to see that they helped me at anything except the harvesting of my berries. A rose within two rods of three wrens' nests lost its leaves by the nice, fat, smooth caterpillars, while the birds hunted out garden slugs beneath the sidewalk. With jays, robins, catbirds and thrushes nesting within a dozen yards of my currant bushes and others only a little more remote, I had to destroy the beautiful slugs with hellebore. On my walnut trees the caterpillars form their processions with their regular ranks unbroken by any beak. True, robins and blackbirds draw a few May beetles and many earthworms from my lawn, but the latter is a blessing; and a wash tub, two bricks, four inches of water and a lantern will kill more of the former in a night than all the birds take in a season, and this combination can be kept out of the cherry tree and the corn patch.

It can not be disputed that man's hope of routing insects is by means of destructive parasites and poisons; and the consumption of the earthworm reminds that the bird may eat as many of the farmer's friends as his foes; but even if the bird did his best as a gourmand, there is a vast host of insect enemies which he cannot reach, and the earth has not gone to the "demnition bowwows" because of this fact. Man has found better means of fighting these pests; and if he is going to fold his hands, and sit ecstatic at the "beautiful balance," and breed birds, it will be a small amount of fruit and farina that he will put between his teeth, be the feather ever so abundant. The most destructive pests in the world are the grain and pea weevils. No bird can affect them. They are hid in the grub state, and fly at night in the moth form, when the beak is under the wing. The work is left to bisulphid of carbon—and it does it without becoming a fetish.

It is well known that the hope of retaining the earth's fertility lies in the legumes, especially the clovers. They have dozens of insect enemies, many of the serious menaces, almost all of which are beyond the birds' reach. The corn-root worm a bird cannot affect at all, and yet thousands of acres are destroyed by it. It is so with the wire worm and others. The bird has never entered the realm of the various destructive fungoid diseases, such as blights, "rots," etc. The "beautiful balance" has never been disturbed here, and yet these pests are on the increase fearfully, because of distribution and conditions of growth. The blight does not prosper where there are no pears nor apples, and the rot is unknown where the potato, tomato and grape are missing. The condition fosters the scourge. If these unthinking enthusiasts would consider that Darwin, Bates and Wallace found South America still in "the beautiful harmony of nature" with the bird abundant and undisturbed, and yet found certain regions where no fence could be maintained long enough to raise a crop, because insects ate the wood, they might get an idea that the beak is a very small affair in any continent's economic relations. There are ant-eating birds on all the continents in primitive abundance, and yet the ant has destroyed for ages everything in its path in spite of them.

The plain fact is that we can do better than the bird. Economically he is not worth his candle. One old sow, properly jeweled, will destroy more white grubs that a hundred crows, and not pull pigs and lambs out of their nests and pick out their eyes, because she can be inclosed. There has been much vaunting of hawks and owls as blessings; and yet a small drove of shoats turned into a meadow will hunt and exterminate gophers and field mice, pursuing them to the last ditch of their burrows, and yet the pigs can be fenced out of the poultry yard. On my lawn under trees are at least half a dozen weeds which have been designated as pests by the United States Agricultural Department—brought there by birds. One is a rumex which I shall never be able to eradicate. There is a bulletin of this department commending birds as weed-seed destroyers, whereas mere common sense with its eyes open knows that they are notorious weed-seed sowers; and that even if they digested all they gorged, there would be left sufficient seeds to sow a dozen worlds like ours each year.

Lastly, if birds were in sufficient abundance to keep in check such pests as they can get at; they would be themselves the greater scourge. These "beautiful balance" enthusiasts should read from the narratives of the early French and Spanish writers what a time the Indians had, when birds were plenty, to keep them from the crops, so that a winter store should remain. The squaws and children had to stay all day in the fields to scare the "starlings" off. I notice that the bird that goes after the worm usually stays for the grain. Such is the case with the roasting-ear thieves; and since every picked ear rots to its base, the bird does more harm than the grub would, because it is rarely that a grub destroys the whole ear. Then, the bird often attacks ears that have no grub. I notice that sparrows which peck at the grubs on the cabbage remain to feast on the leaves, and I have noticed further that the cabbage butterfly may be present in thousands, and birds near them in dozens, without any sort of "economic relations" prevailing between the two.

By all means keep such birds as are worth while. Make their song, beauty, grace and interesting habits a part of our culture—and their preservation part of our ethics; but do not try to foist them on the farmer as an economic asset, for he knows better in many cases. Let's take the bird out of the purse and put him into the heart. He is not to be placed in the class of poisons, parasites, destructive fungi and fall-plowing, but with books and flowers, blue sky and paintings, with music and mother love and all that puts the mere dollar under the heel. That it may not be felt that I talk uninformed, I may say that I was raised a farmer and am an ornithologist of walks and camps and gardens and meadows and have known birds as friends. I do not ask the bird to work for me; and if we spank the small boy who robs, ostracise the "small" woman who wears, and "penitentiary" the plume hunter who kills—all partners alike in a certain sense—we can do more for the bird than by hanging him as a buffer between the earth and perdition.

James Newton Baskett,
Mexico, Mo. Author of the "Story of the Birds."

CHARLES GOODYEAR AND THE HALL OF FAME.

To the Editor of the Scientific American:

At a time when we are still looking forward in wonder of the marvels of this century, it were fitting to single out and to assign to merited place those who have chiefly contributed to make our progress possible. And among them should be ranked Charles Goodyear, the discoverer of vulcanization and the founder of the rubber industry, who has recently received but seven ineffective votes in the choice for the Hall of Fame.

To those acquainted with Goodyear's life, its recurring intervals of keen poverty, the elusive difficulties of his long-prosecuted task, and his extraordinary faith in its final achievement, it would seem that science, art, and industry in the United States, so much indebted to him, by monument or preferably memorial foundation, ought to accord him that distinctive recognition, which the inestimable importance of his discoveries in rubber deserves. This idea was long ago expressed in France, ready to accord to Goodyear his primal right to his great discovery, as she is ever alert to encourage genius in science, art, discovery, or invention. And I beg in closing to translate a paragraph from the comprehensive work of E. Chapel, "Le Caoutchouc et la Gutta Percha," Paris: "Sufficient account has not been taken, in the United States, of the character of this researcher. It is owing to him that we have been able to take so great advantage of caoutchouc, that its employment has become indispensable in medicine, in chemistry, in physics, in electricity, in a word, in all the arts and sciences, in which, in many cases, it permits the realization of progress of the highest importance. We should consider Goodyear *one of the benefactors of his race*, and must regret that no statue to that end has been raised to this Bernard de Palissy of the New World."

Brooklyn, N. Y. Clarke Dooley.

MEASUREMENT OF SMOKE IN THE AIR.

To the Editor of the Scientific American:

Referring to your article in a recent number of the Scientific American entitled "The Measurement of Smoke in the Air," it may be of interest to you to know that the same method of measuring smoke was investigated and formed the subject of a thesis by Mr. Frank W. Everett and the writer at Massachusetts Institute of Technology, 1898.

The apparatus used consisted of a slide carrying a scale of light-absorbing material, constructed by overlapping about fifteen thicknesses of kodak films which had been slightly and uniformly exposed to light and then developed.

This scale was movable and carried an arm bearing a pencil point, which traced a line on a paper carried by a drum revolving uniformly by clockwork.

The operator matched a color seen through one of two nearly parallel tubes pointed at the smoke emerging from the stack to be tested, with the light from the sky adjacent thereto observed through the proper light-absorbing step on the scale. The method was tested by comparing two instruments viewing the same stack from somewhat different points; and although at any minute there might exist a material difference in the reading of the two instruments, the average over a reasonable period of time agreed fairly well.

Wilmington, Del. Irénée du Pont.

The Current Supplement.

The problem of destroying or driving away hostile airships is being seriously discussed by military experts, and its chief technical and tactical peculiarities are admirably reviewed in the opening article of the current Supplement, which is illustrated with practically every type of airship-destroying means known at the present day.—Mr. Grover Cleveland Loening's excellent paper on the "Practice and Theory of Aviation" passes to its fourth installment.—"By Cable to the Arctic" is the title of an article by George E. Walsh, in which he discusses the plan of connecting Alaska with the rest of the world by cable and telegraph.—The Berlin correspondent of the Scientific American writes on "German Airship Sheds."—Prof. Balling has simplified metallurgical calculations by the introduction of a series of factors and their reciprocals, these factors being known as Balling's tables. In order to eliminate the possibility of error in the simple calculations required in using the tables, Prof. Balling has devised a graphic system of right-angle triangles which is described by the Paris correspondent of the Scientific American.—Mr. A. D. Hall read a paper before the Agricultural Sub-section of the British Association for the Advancement of Science on the "Fertility of the Soil," which paper is published.—Mr. C. Fitzhugh Talman of the United States Weather Bureau contributes an article on "Meteorological Isograms," and gives a list which has been collected from a wide range of literature, with a complete definition of this class of words.—Prof. F. Henrich writes on the "New Researches in the Field of Radio-Activity."—The usual Science Notes and Trade Notes and Formulæ will be found in their accustomed places.

The Death of Henri Dunant.

On October 30th Henri Dunant died at Geneva, Switzerland, at the age of 82. Dunant will go down in history as the founder of the International Red Cross Society, the idea of which came to him during the battle of Solferino in Italy in 1859, where he saw needless suffering and loss of life due to neglect. Conceiving the idea of pledging the nations to regard as neutral all sick and wounded combatants and all persons caring for them, he brought about the international conference at Geneva in 1863, at which sixteen governments were represented. At the Geneva convention of the following year, twelve governments signed articles of agreement promising to respect the rights of the injured to mercy and care. It was at that time that the Red Cross flag was adopted. Although Dunant inherited a considerable fortune, he gave most of it away in furthering his philanthropical ideas. A Nobel prize, however, enabled him to spend his old age in comparative comfort.

A special rammer was recently devised in order to avoid making different kinds of concrete simultaneously for the floors, and thus avoid also the danger of lamination incurred when the floor surface, in the first case, is made with special concrete on the wet body mass, or when, in the second, it is finished after the body has set. The flat surface of this rammer is deeply scored by longitudinal and transverse grooves making a series of small projections very much resembling those of an old-fashioned meat pounder. The projections force the stones below the surface and flush up the mortar, so that, after being well rammed, it is easily worked by trowels and floats to give a dense, smooth surface integral with the body of the concrete.

THE LAUNCHING OF THE WORLD'S GREATEST SHIP

THE "OLYMPIC"—A 60,000-TON STEAMER

The launching of the White Star liner "Olympic" at Belfast on October 20th, marks a new advance in naval architecture. Not only is the "Olympic" the largest vessel that has ever been built, but her propelling machinery is of a type that has never been installed on a vessel of such dimensions After the success of combined turbine and reciprocating machinery in the "Laurentic," it was decided to equip the new steamer with both types of engines and with triple screws.

When she is completed the "Olympic" will outwardly resemble the "Mauretania" of the Cunard Line. She will have four elliptical funnels, each 28 feet in diameter. Her length is 883½ feet; her breadth over all, 92½ feet; her breadth over boat-deck, 97 feet; her height from the bottom of her keel to top of her captain's house, 105½ feet, and to the top of the funnels, 175 feet; her freeboard is somewhat greater than the "Mauretania's," being about 52 feet at the top, 45 feet to the level of the main deck, 62 feet to the boat-deck amidships, and 42 feet at the stern. She may be distinguished from other four-funnel ships on the high seas by a single pole-mast forward of the bridge. When she is completed, the "Olympic" will have a maximum draft of 37½ feet, on which she will displace about 60,000 tons, as against a displacement of 45,000 on the same draft for the "Mauretania."

Despite her size, her engines will develop 45,000 horse-power, sufficient to maintain the minimum speed of twenty-one knots, for which she has been designed. The combined reciprocating and turbine engines are so planned that two reciprocating engines will drive the wing propellers, the exhaust passing into a low-pressure turbine driving the center propeller.

The launching weight of the "Olympic," about 27,000 tons, was the heaviest weight ever transferred from land to water; and this operation, always a matter of anxiety to those in charge, was naturally, in the case of so huge a vessel, an undertaking of unusual importance. The method of launching was very simple. The vessel was held on the ways by hydraulic triggers, which were released by the mere opening of a valve, in order that the vast structure might glide into the water.

Some idea of the enormity of the "Olympic" may be obtained when we consider the size and quantity of some of the parts that entered into her construction. Her rudder alone weighs 100 tons, and the weight of the castings comprising the stern frame, rudder, and brackets amounts to 280 tons, or 60 tons more than those of any other steamer. They were manufactured at Darlington, and special arrangements had to be made for their conveyance to Hartlepool, whence they were shipped to Belfast. The largest beam weighs four tons and measures 92 feet; the longest steel plates are 36 feet. There are 2,500,000 rivets in the ship. Each engine crank-shaft weighs 118 tons; each bed-plate, 195 tons; each column, 21 tons; and the heaviest cylinder with its liner, 50 tons; the wing propeller, 38 tons. The weight of the casting for the turbine cylinder is 167 tons, and of one of the solid bronze propellers, 22 tons. The anchors are 19 feet in length and over 15 tons in weight, and each link of their chain weighs several hundredweight. Twelve horses were required to drag one of the anchors to the Naval Exposition at Olympia.

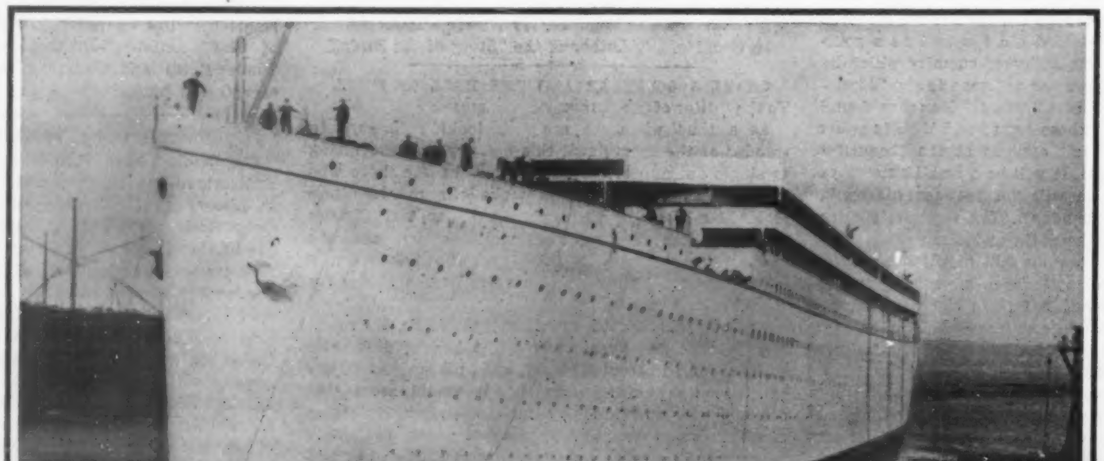
Towing the "Olympic" back to her wharf.

The equipment and furnishings of the vessel have likewise driven home the gigantic size of her hull. Besides the usual dining rooms, lounges, saloons, drawing and smoking rooms, restaurants, and verandas and cafés, all beautifully decorated, the "Olympic" will be provided with a complete and well-equipped Turkish bath, a spacious swimming bath, a full-sized squash and racquet court, with a gallery for the use of spectators of the game, electrical bath establishments, sun parlors, sport decks, palm courts, lifts, gymnasiums, etc. These accommodations are provided for 2,500 passengers. The crew will number 860.

Since the advent of the "Great Eastern" in 1858, no vessel, except the "Mauretania" and "Lusitania," has created such a vast amount of comment as the "Olympic," not only on account of her enormous size, but also because she represents a new type in naval architecture. In our issue of June 19th, 1909, we published an article on the "Development of the Transatlantic Steamship," in which we traced the evolution of the modern liner from the old "Britannia," which was the first vessel that ever crossed the Atlantic on a regular schedule, to the present-day "Olympic." We pointed out, at the time, that between the "Britannia" with her length of 215 feet and her speed of 8.5 knots, and the "Olympic" with her enormous length of nearly 900 feet and her minimum speed of 21 knots, the changes in construction and in propelling machinery have been remarkable. The two decades that followed the advent of the "Britannia" saw the advent of the "Asia" in 1850, a vessel with a length of 275 feet and a speed of 12.5 knots, and the "Persia," an iron steamship built in 1855, with a length of 385 feet and a speed of 13.8 knots. Then came the "Great Eastern," Brunel's naval masterpiece, a ship so far in advance of her time that she proved a commercial failure, but nevertheless a harbinger of the development which has given us the "Olympic." The "Great Eastern" with a length of 692 feet and a displacement of 28,000 tons, was not exceeded until the "Oceanic" made her appearance in 1899 with a length of 705 feet, a maximum displacement of 32,500 tons, and a speed of 20.7 knots.

The "Great Eastern" marked the transition from the paddle to the screw; for she was equipped with both. The "China," built in 1862, a ship 337 feet in length with a speed of 14 knots, was propelled by a single screw only. After that the screw propeller completely displaced the paddle wheel. Up to the time of the "City of Paris" and the "City of New York," practically all of the vessels were driven by single screws, a method of propulsion which reached its highest development in the "Umbria" and "Etruria," 525 feet in length with 19.6 knots of speed and engines of 14,500 horse-power. With the "City of Paris" and the "City of New York" began a new period of twin-screw ships driven by triple-expansion engines. When they went into service in 1889, they were by far the finest ships afloat, as well as the largest. They were 560 feet in length, and had a displacement of 16,000 tons.

The improvements that followed the building of the (*Concluded on page 391.*)



The "Olympic" just after she was launched.

THE LAUNCHING OF THE WORLD'S GREATEST SHIP.

THE INTERNATIONAL AVIATION MEET

THE PERFORMANCES AT BELMONT PARK

Continuing the description of the events of the meet each day, which was begun in last week's paper, we print the following account:

Friday, October 28th.—Mr. Ralph Johnstone returned in spectacular style from Middle Island, in Great South Bay, the point 55 miles distant, where he had been blown the night before by a gale while achieving his new altitude record of 8,471 feet. He made the return trip with one stop for fuel. During the morning hours, Hoxsey also flew back from Brentwood, the point 25 miles distant from Belmont Park, where he had landed the night before in the same gale.

Early in the afternoon Hoxsey wormed his way up into the air in another attempt for the altitude record. He remained aloft for 2 hours and 17 minutes, and attained a height of 6,705 feet. His only competitor was Parmalee in a standard Wright machine, which he succeeded in driving to an elevation of 3,819 feet. Latham won all the honors in the hourly distance competitions of the day. His competitors were De Lesseps and Audemars.

In the cross-country passenger-carrying contest, De Lesseps ascended with his brother. He was quickly followed by Moisant, carrying Mr. Frederick Thompson. Claude Grahame-White went up in his Farman with Mr. Sydney MacDonald, but failed to start in the contest. Moisant was compelled to descend about 4 miles out from the grounds. He returned alone in the course of half an hour. De Lesseps rounded the balloon which marked the outer end of the cross-country course, 10 miles away, in 12 minutes and 12 seconds. Luck was against him, however, for he was compelled to land at Garden City.

The little Demoiselles, mounted by Garros and Audemars, made only short flights. In alighting, Audemars's machine buried its nose in the turf and turned a complete somersault, without injuring the aviator, however.

Other exhibitions of the day included flights by Brookins in the small Wright flier (30 horse-power); Charles K. Hamilton in his Curtiss-type machine; Ogilvie, of the English team, in his Wright biplane; and McArdle, an English substitute.

The wind was too high for the Statue of Liberty contest.

The results of the day were as follows:

First Hourly Distance—Won by Latham, four laps, time 14m. 25s.; second, Audemars, one lap, 2m. 24.5s.; third, De Lesseps, one lap, 2m. 36.35s.

Second Hourly Distance—Won by Latham, twelve laps, time 43m. 59.4s.; penalized three laps for fouling pylon; no second or third.

First Hourly Altitude—Won by Hoxsey, 6,705 feet; second, Parmalee, 3,819 feet; no third.

Second Hourly Altitude—Won by Parmalee, 3,636 feet; second, De Lesseps, 2,240 feet; no third.

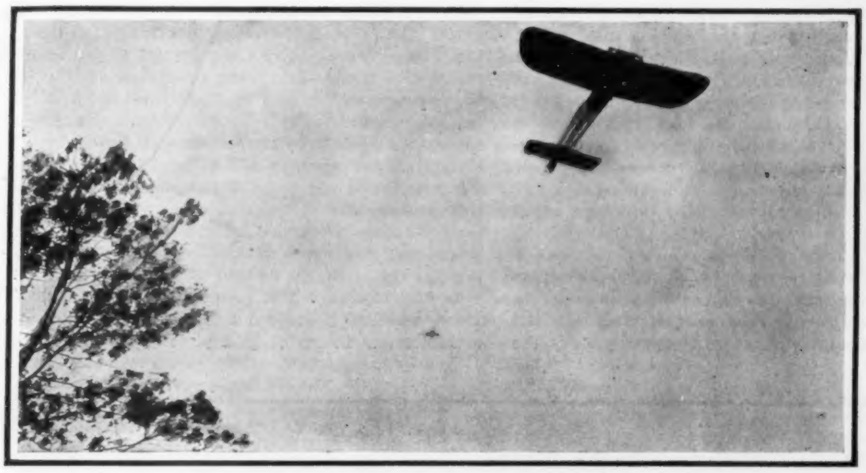
Totalization of Duration for the Day—Won by Parmalee, 1h. 40m. 25.4s.; second, Latham, 1h. 11m. 34.6s; third, Hoxsey, 57m. 33.25s.

Thursday's Second Hourly Altitude—Won by Johnstone, 8,471 feet (new American record); second, Hoxsey, 6,903 feet; no third.

Saturday, October 29th.—This was the appointed day for the great international speed contest for the Bennett aviation trophy. The weather was perfect during the early morning hours, and several of the foreign aviators, notably Leblanc, Grahame-White, and Radley, made practice flights at about 7 o'clock. The 62.1-mile race, which consisted of 20 circuits of the larger or 5-kilometer (3.1-mile) course, began at 8:42 A. M. when Grahame-White, representing England, started in his 100-horse-power Blériot monoplane, and made his initial circuit of the course in 3¼ minutes. While he was on his third lap, Alfred Leblanc, France's chief representative, started in a similar machine and covered his first lap in 2 minutes 45.63 seconds, thus breaking the world's record, made at Rheims, of 2:48 2-5. M. Leblanc started at 20 seconds after 9 A. M. The third starter was Mr. Alec Ogilvie in the small Wright biplane. Mr. Ogilvie represented England. His start was made at 9:08 A. M.

The three machines raced around the course at high speed, and made an interesting spectacle for the crowd

(*Continued on page 389.*)



Two Bleriot monoplanes viewed from beneath.
The smaller of the two is Drexel's Bleriot at a height of 7,000 feet.

Latham's Antoinette soaring above the trees in the race for the International Trophy.

By courtesy of the New York Evening Sun.

Leblanc's 100-horse-power racing Bleriot monoplane after striking a telephone pole. Leblanc lost the Bennett Cup Race through a forced descent which resulted in the above accident. He was on his last lap at the time.

Note a section of the pole, with the bottom cross-member of the aeroplane's frame imbedded in it, lying under the machine. One blade of the propeller, as well as the wheels of the monoplane, was ripped off in the crash which occurred when Leblanc was traveling at the rate of 70 miles an hour.

MONOPLANES WHICH COMPETED IN THE INTERNATIONAL TROPHY RACE AT BELMONT PARK.

A NEW ELECTRIC LOCOMOTIVE

BY PERCY COLLINS

As a result of some years devoted to experimenting and the expenditure of a huge sum of money, the North British Locomotive Company, Ltd., has just completed a locomotive which is entirely novel in principle and in form. This engine has already made a very successful run from Glasgow to Gartsherrie on the Caledonian and North British railways. It is the first steam-turbine-electric locomotive ever produced, and it is said to possess many points of superiority over the ordinary locomotive, which it is intended to supersede. The electricity which actuates the motors is generated by a dynamo, which in its turn is driven by a turbine engine deriving its steam from a boiler of ordinary locomotive type, fitted with a superheater, situated in the rear. There are coal bunkers and water tanks at each side of the boiler.

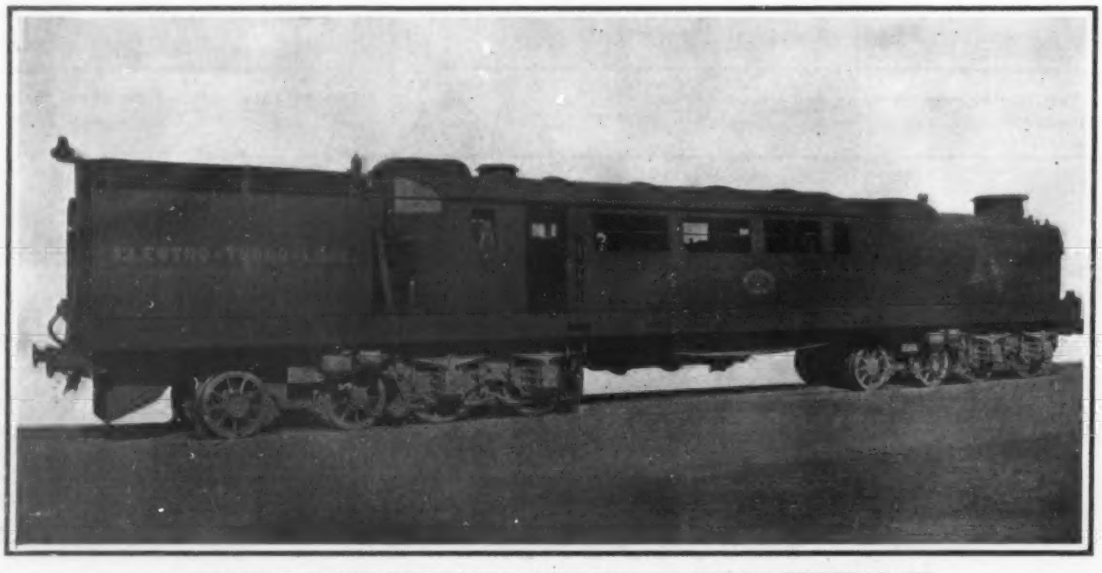
The Zoelly steam turbine makes 3,000 revolutions per minute, and is directly coupled to a continuous-current variable-voltage dynamo. The dynamo supplies current and pressures varying from 200 to 600 volts to four series-wound traction motors, the armatures of which are built on the four main or driving axles. The nominal horse-power of the locomotive is 1,000.

From the turbine the exhaust steam is passed to an ejector condenser, and is, together with the circulating condenser water, delivered eventually to the hot well, whence it is returned direct to the boiler by means of a feed pump. This is allowable as—the steam turbine requiring no internal lubrication—the water of condensation is quite free from oil. The evaporated water is therefore returned to the boiler again and again, and the supply of water carried in the tanks is actually circulating water for condensing purposes. Small auxiliary steam turbines, placed alongside the main turbine and dynamo, drive small centrifugal pumps, by means of which the condensing water is circulated within practically a closed cycle. This cycle is from the tanks through the first pump, then through the condenser where it becomes heated in condensing the exhaust steam, then to the hot well. Thence it enters the second pump and is passed to the cooler, which is situated in front, where the blast consequent on the forward movement of the locomotive (aided by a small fan) is utilized for cooling. Finally, the water is passed again to the side tanks and is ready for further condensation.

It will be apparent that condensation of the steam must deprive the locomotive of the usual exhaust blast through the firebox and boiler tubes. This blast is replaced by means of the small turbine-driven fan, situated within the cooler, which, while it delivers hot air to the furnace, also assists the passage of air through the cooler.

The switchboard and the instruments required, the controller for grouping the four motors in series, series-parallel or parallel, according to the drawbar pull to be exerted, and the regulator for controlling the voltage in the electric circuit, and consequently the speed of the train, are all placed on the driver's platform within easy reach.

As this locomotive is entirely self-contained, the necessity for external wires or live rails is done away with. It can travel over any lines. The finishing touches are now being given to the locomotive, which will shortly undergo exhaustive tests as a hauler of express trains.



A NEW SELF-CONTAINED ELECTRO-TURBO LOCOMOTIVE FOR HAULING EXPRESS TRAINS.

The Use of Metals 6,000 Years Ago.

BY EDGAR J. BANKS.

Excavations in the oldest of the long-buried cities of Babylonia have yielded three metals which were then in common use—copper, gold, and silver. If others were employed, they have not yet appeared in the most ancient strata of the ruins at Bismya, Telloh, and Nippur, where the earliest traces of civilized man have been discovered. We generally speak of the bronze age as a time when early man discarded his implements and weapons of stone for those of metal, but in Babylonia and also in Egypt there was an age which intervened between that of stone and of bronze. It might be called the copper age, for all of the objects found in the most ancient of the ruins, which are generally regarded as bronze, are shown by analysis to be practically pure copper; bronze objects appear first in ruins of a far later date.

Common among the early copper objects are the spear points, both flat and round, about twelve inches long, and almost identical in shape with those attached by the modern Bedouin of the desert to the ends of long bamboo shafts. Though every trace of wood from this early Babylonian age has disappeared, a copper rivet capped with gold, which held the blade to the shaft, has survived. Common copper objects found in the graves of the early Babylonian women, are huge pins about ten inches long, and capped at the larger end with a polished lapis-lazuli or carnelian bead. Though now badly corroded, the pins were once polished, and possessed considerable grace and beauty. Their location when found in the grave, seems to indicate that they were hair-pins. Along with the ancient hair-pins should be mentioned the copper needles which were recovered from among the ruins of the private houses. Though several times larger than the modern needle, they were of practically the same shape, even to the eye. Of copper jewelry the Babylonian graves have yielded several interesting examples. The jewelry of both the poor and the rich seems to have been of that material. There were finger rings and bracelets and nose rings in large numbers, and occasionally in one of the last is a small sea shell with which it was set. There is a single instance of a necklet of copper wire. Though we may consider nails and rivets as modern institutions, copper nails and rivets of various modern shapes were commonly employed. The implements used by the farmers were also of copper; one resembling a reaper's cycle was attached to the handle by a copper band, as is the modern cycle. Dishes of various shapes, but generally very shallow, were frequently of copper; and in one of the Bismya house drains several copper drinking cups were discovered. Perhaps the most interesting of Babylonian copper objects are sets of four small instruments which were held together by means of a ring, and incased in a funnel-like copper protector. One of the instruments was a pair of tweezers; the others were blades of various shapes. They may have been a surgical or a manicure set, or possibly they were the tools with which the engraver carved the beautiful cylindrical seals from the hardest of stones. Copper was also employed upon rare occasions for making toy animals for the children, and the Babylonian scribe also engraved his wedge-shaped characters upon tablets of copper. Several such copper tablets from Bismya are now preserved in the archæological museum of the University of Chicago. The tempering of copper, now generally considered a lost art, was commonly practised in Babylonia 6,000 years ago. The hardest of stones were then engraved with a skill unsurpassed in modern times. The tempered copper, however, is now so corroded that it is exceedingly brittle, while some of the untempered objects are still as malleable as ever.

In the very ancient Orient, gold was more common and of less value than silver. While quantities of gold objects of various sorts were found in the ruins at Bismya, but one small finger ring of silver was recovered. At Telloh, however, the French archæologists found a large beautifully engraved silver vase mounted upon a copper pedestal. The vase, now in the Louvre, must have been one of the most valuable objects among the treasures of the Babylonian kings.

Of the gold objects from Bismya, the greater part were not solid, but filled, the baser material being bitumen, a native substance which was then and is still used in Mesopotamia for a great variety of purposes. The gold beads appearing in quantities in the graves of the females are now but hollow shells, for the bitumen within them has crumbled to powder and fallen out. Traces of the copper thread upon which the beads were strung, still remain. Shell-shaped ear and nose rings, always filled with bitumen, were among the most beautiful of the gold ornaments of the Babylonian women. A large gold-filled rosette, set alternately with red and blue stones, shows the perfection of the art of the goldsmith, yet perhaps the most striking adornment of the Babylonian woman was a gold band about three inches long, and tapering toward the ends, which apparently she bound upon her forehead. That gold was very common in Babylonia 6,000 years ago is evident from its use in architecture. Pieces of gold plate are found in the ruins of the Babylonian temples; it was probably employed in overlaying the walls, or the large statues of kings and gods. One piece of inscribed gold bears the name of Maram Sin, a well-known Semitic king of 3750 B. C. Evidently it was a part of the gold dress which covered his statue.

It would be difficult to say from just what place ancient Babylonians obtained their metals. It is now known that the earliest of the Egyptian kings sent expeditions for copper to the mountains of Sinai, and there the earliest of their sculptures are found. The inscriptions of the Babylonian kings of the earliest times speak of the intercourse with the Mediterranean coast—"And then a Babylonian fleet sailed on the sea." One may therefore conjecture that the Babylonians also obtained their copper from Sinai, and that their gold and silver also came from the same mines which the Egyptians worked.

Maine's Output of Metal.

The quarries of Maine are well and widely known and supply immense quantities of stone—especially granite—for use in all parts of the country, but the ores of the State are not now extensively mined. For many years the ores of Mount Katahdin produced 2,000 to 15,000 tons of iron a year and in the early sixties the Lubec and other lead mines were worked in a small way. In the eighties several hundred tons of copper were smelted at Bluehill from ores mined at the Douglas and other mines in the neighborhood. In addition to this metallic output, about 5,000 ounces of silver has been mined at Sullivan and Bayard Point. The total value of the metal product of Maine except iron is probably about $400,000.

The Illinois Traction Company is building a coal submerging and storage plant at Mackinaw Junction, Ill., midway between Peoria and Bloomington at the intersection of the line from Springfield. An excavation 250 feet by 100 feet is being made. The sloping sides of this excavation and the bottom will be covered with concrete, so that when the excavation is filled with coal water may be pumped in to protect the fuel from deterioration or spontaneous combustion. Mechanical apparatus for reloading the coal will be provided.

CURIOSITIES OF SCIENCE AND INVENTION

PORTABLE ELECTRIC MOTORS FOR FARM USE.

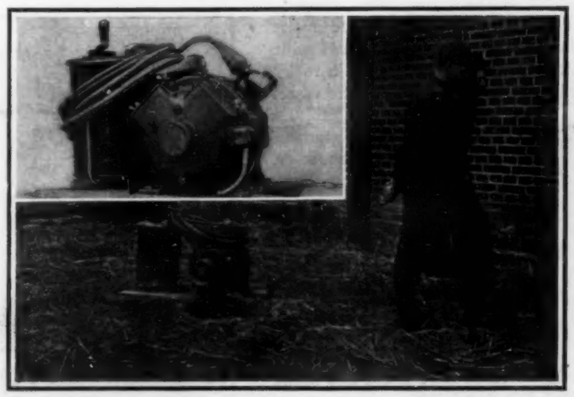
The operations of a farm cover such a wide territory that it is essential that power appliances for farm use should be portable. A firm in Berlin is constructing such special types of portable electric motors. Those motors, which are to be substituted for manual labor, do not have to be of a higher capacity than 1 horse-power. Being used mainly in granaries and hay-lofts, they should be of light weight so as to be readily transported by hand up and down stairs. The carrying devices constructed for outputs of up to 1 horse-power with reduction gearing are, therefore, of a total weight of only about 200 pounds. Larger motors of from 7 to 10 horse-power are arranged to be transported on sledges. These motors weigh from one to three tons and may be hauled to the fields in wagons.

Small motors with their gearing are mounted on a light carrier provided with four handles. On the under side of the carrier are four sharp points, which, on setting down the motor, will sink into the floor so as to provide a fixed and steady base. As the electromotor does not require any superintendence, apart from starting and stopping, one to two hands can be saved as compared with previous practice, quite apart from the fact that in contrast to manual labor, motors will never get tired.

A special advantage of large motors mounted on sledges is that the machine to be operated can be brought into its most favorable position, after which the motor is adjusted to it. The sledge is fixed by a mooring chain to a pin driven into the ground, and a tightening device on the chain is used to control the belt tension. The sledge may be drawn by a horse or by two men from one spot to another.

A third type of portable motor is that carried on special carts. This is mainly used on large farms for operating large threshing machines, straw presses, elevators, chaff-cutting machines, etc. Being independent of the machinery, it can be used as well for actuating fire engines, saws, lifts, etc.

SMALL PORTABLE MOTOR FOR FARMERS.



LARGE PORTABLE MOTOR MOUNTED ON A SLEDGE.

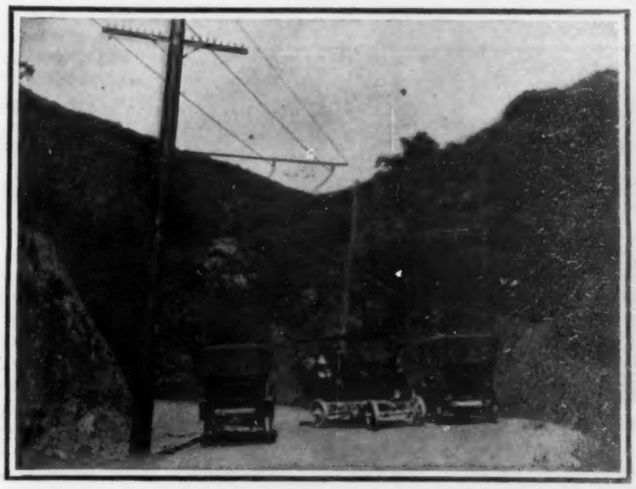
The motor and controller are incased to prevent the entrance of any dust and rain. Apart from the handwheel for starting and stopping the motor, there projects from the cart only the belt pulley from which the energy is to be transmitted to the machinery. Connection with the power circuit is effected by means of contact boxes, which can be fitted anywhere in the open.

THE FIRST TRACKLESS TROLLEY IN AMERICA.

The first commercial trackless trolley in America has been lately installed in Laurel Canyon near Los Angeles, Cal., for the purpose of handling passengers from the lines of the Los Angeles-Pacific Railroad Company to "Bungalow Land." It rises 600 feet in its mile and a half length, and is a marvel of circuity. The road traversed is mostly curves, there being only 1,000 feet of tangent, and the grade ranges from 5 per cent to 12 per cent; hence this road is well suited to test the practicability of the system. The cars however glide in and out with marvelous ease. Germany's experience with the trackless trolley has been that it is best suited for use in steep mountain grades, where speed is not essential. On the Laurel Canyon route a maximum of 25 miles an hour is possible on a straightaway run, but 10 miles is all that is attempted on curved portions of the line.

Transportation previous to the installation of this trolley system was by automobiles, and these were too uncertain and, owing to the grade, too expensive to maintain. The expense of constructing a track and overhead for the regular system would have been expensive, as the road is a pass in the hills and it would also have ruined the road for automobiles, many of which pass over the route, and would also have marred the scenic effects, which are especially charming in this locality. For these reasons the trackless trolley seemed a logical solution, as it combines simplicity, reliability, and economy both in the first cost and in operating charges.

The old gasoline motor buses, two in number, were stripped of the original motive power, and fitted with two especially designed and constructed motors of 15 horse-power rating, 500 volts, each motor driving one rear wheel by chain, thus eliminating the differential. The control consists of a series parallel controller mounted on the dash, to the left of the steering wheel, the reverse switch being separate, under the driver's seat, and operated by a handle to the right of the wheel. The usual expanding and contracting brakes are fitted, as in a regular automobile. The trolleys are mounted on the roof of the bus, approximately 24 inches back of the front axle and spaced 48 inches apart, which is also the spacing of the trolley wires. The poles are of wood, 15 feet long, and carry a special swiveled form of collector at the end, which is arranged to slip off without damage in case the pole should leave the wire and the collector catch on the overhead. These trolleys allow a total variation of eleven feet each side of center on the roadway, and at slow speed will operate when making a horizontal angle of 75 degrees with the trolley wire, and will also allow the car to be completely reversed in direction under the wires without change, although it is, of course, necessary to turn the poles after the car has turned and before it can proceed, because the poles are crossed and projecting forward from the car. The trolley wires are of grooved copper suspended from pipe arm brackets fastened to telephone poles along the roadway, these being sometimes on the right and sometimes on the left-hand side of the road. The cars however always obey the rules of the road, and pass to the right of approaching vehicles, regardless of the location of the trolley wires.



TRACKLESS TROLLEY TURNING OUT TO PASS AN AUTOMOBILE.

NOVEL CRANKLESS BICYCLE.

It would almost seem as if the bicycle had passed its stage of development and was incapable of further improvement; but an inventor in Austria has just perfected a unique crankless bicycle, for which a large saving of power is claimed. Two long levers and a chain run over several pulleys. The rider consequently does not move his feet in a circle, but only up and down, which is far less tiring than the old way. For this reason, and the peculiar design of the levers, a saving of 50 per cent in human power or a gain of 50 per cent in speed is secured. This estimation of the inventor has been proved by practical demonstrations. The feet rest upon pedals fitted at the end of a pair of long arms. A single chain connects the two arms, running first up over two pulleys, and then to the rear over two sprocket wheels fastened to the hub. The chain halves then go forward, and are united on a pulley fixed to the inclined frame tube. In the hub there is a free wheel ratchet device whereby first one and then the other sprocket serves to drive the hub. One portion of the chain is always tight and rotating one sprocket wheel, while the other is loose. The rider can alter the degree of transmission at will from high speed to low speed during riding. He may press down the levers an inch or a whole foot, that is, as far as the length of the chain permits. He also can lengthen or shorten the swinging arms to vary the leverage.

CRANKLESS BICYCLE WITH SPROCKET GEAR.

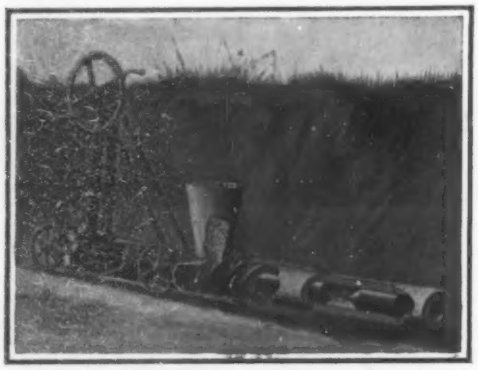
CHAIN GEAR OF CRANKLESS BICYCLE

MAKING CONTINUOUS CONCRETE PIPE.

The accompanying engraving illustrates a novel machine for making continuous concrete pipe. The machine consists of a tubular body or casing mounted on wheels. The pipe-forming apparatus is at the rear end of the tubular casing, and comprises a worm or screw member carried by the shaft, which extends longitudinally and axially of the casing. The shaft at its forward end is connected by suitable gearing to a flywheel provided with a crank handle, so that by the operation of the crank handle the worm will be turned. The upward frame extension of the machine has a cross-piece serving as a handle for holding the machine with one hand while the other operates the crank-handle. For machines of large capacity, the motive power may be supplied by an engine or motor of any design required. The shaft is also geared to the front wheel, to cause forward traction of the machine when the crank is operated.

The worm or screw extends in the molding chamber and fits snugly within the casing, so that its threads work close to or against the sides of the casing. Above the forward end of this worm the casing has a feed opening, over which is placed a feed hopper, for the reception of the cement or material to be molded into pipe. The tubular casing has a slight rearward flare, and extends rearwardly beyond the rear end of the screw member, to fit around the formed cement pipe and support it temporarily. A core extends rearwardly and axially from the screw member to enter within the formed pipe, and temporarily sustain the pipe, and by its rotary motion to aid in the

formation and compacting of the pipe. The core is made flexible to enable it to accommodate itself to any slight deflections in the relative directions of the machine and pipe without breaking and cracking the pipe already formed. A follower member is connected to the core member by means of a swivel joint, which enables the core and screw members to rotate without rotating the follower while they draw the latter forward. The object of the follower is to press out the rifled or helical formation within the cement tube, due to the rotating core. The outer face of the pipe is



MACHINE FOR MAKING CONTINUOUS CONCRETE PIPE.

smoothed and compacted by a sleeve having an annular flange whose inner diameter is substantially the same as that of the rear end of the casing. The sleeve is continuously rotated in the operation of the machine.

The device is operated in the ditch where the pipe is to be laid. The cement is continuously supplied to the worm, and a continuous cement pipe is ejected from the machine. As the pipe is formed, there is a forward reaction on the machine, tending to advance it in proportion as the pipe is formed, the machine being guided and held in proper place by the handle.

SCULPTURES OF THE PIONEER HYDRAULIC MINER.

There are many places in middle and central California where enduring monuments of the old pioneer hydraulic gold-mining operations remain still to be seen. One of the most important "object lessons" of

LONE PINE BUTTE CARVED BY THE HYDRAULIC JET.

this work of half a century ago, stands not far from the town of Nevada City, Cal.

This is shown clearly in the accompanying photograph. It is known far and wide as the "Lone Pine Butte." Where this little butte now stands was once a high hill, but millions of cubic yards of earth, sand, and gravel have been washed away, and all of the fine precious metal extracted from them. This work was done in the course of years of mining operations, until ultimately the operations at this particular point were totally abandoned, as the gold became too scarce to pay for the working.

This "Lone Pine Butte" is nearly 200 feet high and almost perfectly square at the top, as may be seen in the photo. On the very edge of the pinnacle stands one little pine tree. Why it maintains its poise so very near the edge, has long been a source of wonderment. With its very slender rooting it grows flourishingly, and defies the force of the winter storms.

A FAKE AUTOMATON.

It was Barnum who discovered that the public likes to be hoaxed, and there is something very pleasing about a clever imitation. The accompanying photograph, however, shows a step further in this direction, namely, an imitation of an imitation. The doll figure performs many wonderful feats that are a good imitation of real life, all apparently under the control of the ma.. with the electrical switchboard. As a matter of fact, however, this is not a real automaton, but a living person dressed up after the manner of a doll, who moves her arms and feet in a jerky manner that deceives the most wary. The uninitiated would never suspect that this imitation of real life is not a real imitation, but an imitation imitation.

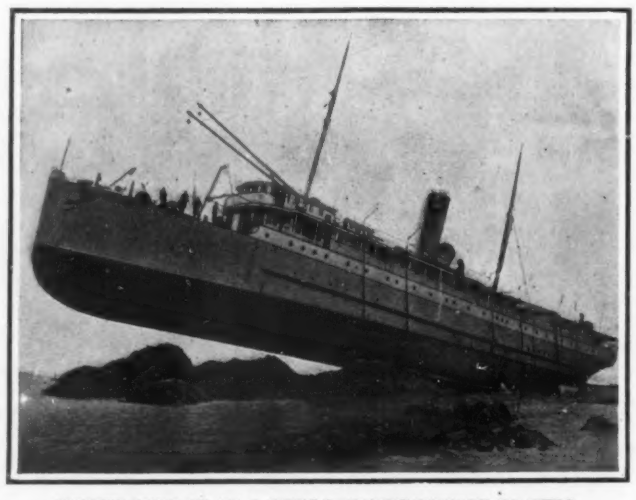
ELECTRIC FLAGMAN FOR TROLLEY LINES.

An automatic device to replace a flagman at railroad crossings has been tested on the Pacific Electric Railroad, one of the largest interurban trolley systems in the country. The "automatic flagman" consists of a ten-foot pole with the following equipment: a gong, two white lights and a red light for use by night; and for daylight signaling, a two-foot disk painted red, which bears in large white letters the words "LOOK OUT." This swings in an iron groove, and is thrown into a conspicuous position at the approach of the car. Two rails, 1,500 feet from the signal pole in each direction, are placed along the track in such a way that when the car runs over them, the automatic flagman is electrically operated. The bell rings, the "flag" swings out, and at night a red light illuminates the center. The white lights burn all night at the crossing, enabling the motorman to see plainly any passenger waiting to board the car.

ELECTRIC FLAGMAN.

AN EXTRAORDINARY WRECK IN ALASKA.

Steaming along in the neighborhood of Sentinel Island in the Lynn Canal, Alaska, during a heavy fog in the night the "Princess May" of the Pacific Steamship Company ran on a rocky ledge. Tide was high, and the vessel rode far up on the rocks. As the tide fell, the stern of the vessel sank, because of the heavy machinery therein, lifting the bow up clear. The hull was not damaged in the least, and there was no leakage, the only serious damage being that of the right propeller. The vessel shows remarkable rigidity, and it is marvelous that it did not break in two. Aid was summoned by wireless telegraphy, and a sister ship, the "Princess Royal," was soon on hand to render aid. The vessel was firmly affixed in the position which is clearly shown in the photograph, but in such a manner that it would rise and fall with the tide. While it is in no immediate danger, the problem of removing the vessel is an extremely difficult one. It has been suggested that the rocks be blown away with dynamite, but this would undoubtedly be a ticklish task, for it might involve the destruction of the vessel.



DRIVEN HIGH UP ON A REEF WITHOUT DAMAGE TO HULL.

AN IMITATION MECHANICAL DOLL.

UNIQUE ELECTRIC CLOCK.

An ingenious clock has just been completed by the students of the St. Louis Watchmaking School. It has no mainspring or weight, but will run continuously if connected with a battery or with the electric light circuit. The pendulum swings above the movement instead of below, and receives an impulse every two seconds. At every swing of the pendulum it moves the fork, by means of a pin projecting from the back of the pendulum ball, somewhat after the order of a

UNIQUE ELECTRIC CLOCK.

chronometer escapement. The pallet, which is fastened to the fork, moves the escape wheel every second, as the pendulum swings back and forward. Owing to the fact that the electric current is practically invariable, this clock will keep better time than a clock running by mainspring or weight.

CURIOUS CHEMICAL GROWTH.

When the Northampton High School, Massachusetts, was closed at the end of June, a small bottle containing a solution of arsenic trioxid in strong hydrochloric acid was left upon the shelf of a closet. The bottle was closed with a ground-glass stopper. When the closet was opened this fall it was found that part of the contents of the bottle had escaped and deposited in snowy crystals on the neck of the bottle. The curious formation of these crystals is shown in the accompanying photograph. Upon breaking the deposit, it was found to be largely hollow, with a few crystals arranged radially. Another bottle under the same conditions produced a feathery cap, like new-fallen snow on a fence-post.

A CURIOUS CHEMICAL GROWTH.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

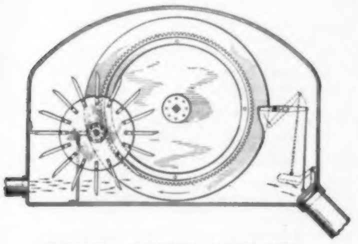
ABDOMINAL SUPPORTER.—M. W. Ferris, South Orange, N. J. The object of this improvement is to provide a supporter, whereby the abdominal pad is held at all times in proper supporting position relative to the abdomen of the wearer, and without danger of the pad slipping upward and out of position, at the same time allowing sufficient yielding for the comfort of the wearer, and permitting convenient adjustment for accurately fitting the wearer's body.

Of Interest to Farmers.

CALF OR COLT WEANER.—J. Pivny, Wasta, S. D. This appliance may be readily secured on the head of an unweaned calf or colt, and while permitting the animal to graze freely, or to take liquid or solid food from a trough or the like, will by contact with the mother of parts of the weaning device, cause pain, and thus induce the cow or mare to repulse all attempts of the young to nurse in the usual way.

Of General Interest.

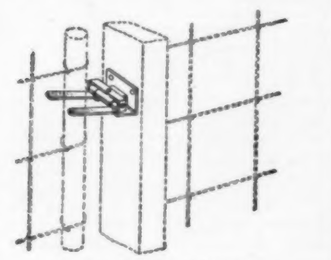
FLUSHING APPARATUS.—O. T. Richey, Tucson, Arizona Territory. The apparatus comprises a watertight casing with an inlet and outlet pipe. The outlet valve is operated by turning a hand lever, the inrushing water impinging on the vanes of a water wheel sets the latter in motion. The shaft of the water



IMPROVED FLUSHING APPARATUS.

wheel is geared to a cam disk, which, while it is in motion, holds the outlet valve open, as indicated by dotted lines, but at the end of one rotation the valve lever enters a notch in the disk, permitting the valve to close by gravity and be retained by the pressure of the water.

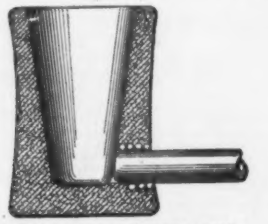
LATCH.—Alva Cline, 717 Linden Street, Lima, Ohio. Mr. Klein's latch is particularly adapted for use in connection with gates which may be raised and lowered, and opened to either side. The latch comprises a pair of leaves separately hinged, but connected by a bar in such a manner that when one is raised,



LATCH FOR FENCE GATES.

the other will be moved laterally. After one of the leaves has been raised to permit of opening the gate on that side, the gate on its return will strike the other leaf, moving it back to the normal position and thereby causing the first leaf to drop to horizontal position and secure the gate.

SMOKING-PIPE.—B. T. Genthner, Foxcroft, Me. The purpose of this invention is to provide a pipe bowl of plastic material with a reinforcement which will not only strengthen the bowl, but will also serve as a socket for



REINFORCED SMOKING PIPE.

the reception of the pipe stem. The reinforcement consists of a wire coil with the ends projecting, this being embedded in the plastic material of the bowl. The pipe stem, being usually made of comparatively soft material, may be then readily screwed into the socket, the convolutions forming the necessary thread.

EMBLEM-FASTENER. — D. S. Haynes, Evansville, Ind. The invention refers to separable buttons and like devices, and its purpose is to provide a fastener more especially designed for use in securely, quickly, and conveniently fastening emblems, buttons, and the like in position in the buttonhole of the lapel of a coat or other garment or to allow of removing the same whenever desired.

BED-STRAP.—Mrs. F. Salinger, 180 Elm Street, New Rochelle, N. Y. The invention provides an improved safety strap for holding a small child in bed and preventing it from uncovering itself by its tossing and kicking. Two straps are provided, which pass lengthwise around the bed at each side of the child, while

SAFETY STRAP FOR CRIBS.

there is a cross strap that may be adjusted to any desired position over the child. The cross strap is provided with an elastic section which enables the child to move freely within the limits imposed. The straps are provided with reinforced eyelets, through which safety pins may be passed to fasten the straps to the bedding.

COMBINATION LEVEL AND SQUARE.—G. W. Wolcott, Healdsburg, Cal. With the instrument here illustrated, one may readily square and level the foundations of a building. The device may also be used for setting out

COMBINED LEVEL AND SQUARE.

orchard trees and vines, and lining them in a perfect rectangle. The device comprises a pair of telescopes, disposed at right angles to each other and each furnished with a spirit level. The telescopes are mounted on a frame, which in turn is supported on a cable, capable of accurate adjustment with respect to a base plate. The table is graduated to indicate the variations of the frame plate from normal position.

BOAT-CANOPY.—R. L. Kenyon, La Crosse, Wis. The invention is an improvement in boat canopies or tops and has in view a canopy supported by stanchions or bows from the deck or coaming, and provided with an end extension foldable to the body of the canopy and arranged over one end of the cockpit to permit ease of entry and exit to and from the boat.

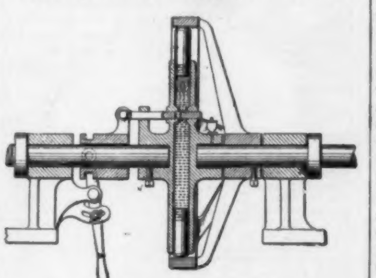
Heating and Lighting.

SCALE-PREVENTER FOR BOILERS.—J. W. Stephens, Staunton, Va. This device separates sediment and sediment-producing salts from the feed water before it is admitted to the boiler proper, by preliminary heating the water within the boiler, passing it through a plurality of settling tanks and a skimming tank, removing the sediment from the boiler, filtering it, and returning the purified water to the boiler.

Machines and Mechanical Devices.

SLITTING ATTACHMENT FOR PAPER-MACHINES.—W. J. Dolan, Rhinelander, Wis. This invention relates to slitting attachments for paper machines, and more particularly to a device of this class which comprises a number of swinging arms, operable individually and together, each of the arms carrying a cutter and being adjustable, so that a web of paper can be slit into a number of different widths by means of the attachment.

CLUTCH.—H. W. Lloyd, 805 East Beaver



VARIABLE SPEED CLUTCH.

Street, Jacksonville, Fla. The object of this clutch is not only to transmit motion from a driving to a driven shaft, but to vary the speed of transmission without intermeshing gears and without any break or interruption in changing from one speed to another. The clutch is provided with a chamber, in which a liquid is confined, and the liquid is circulated when the driven member rotates at a lower speed than the driving member. By controlling the rate of flow of the liquid the relative speed may be varied at will.

ADDING APPARATUS.—J. W. Alexander, Spartanburg, S. C. This invention is a simple educational apparatus for use in the instruction and practice of children in adding numerals, besides being usuable in other allied operations of subtraction, multiplication, and division. The pupil by its means will quickly acquire proficiency in the required operation.

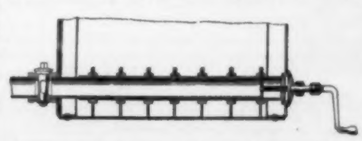
SHIP-HULL CLEANER.—J. M Towne and P. E. Gibson, Tampa, Fla. This device cleans the hulls of ships of scale, barnacles, paint, iron rust and other crusts, and the machine is designed to be manually moved over the surface to be cleaned, and embodies a rotary cylinder having a series of chisels or cutters, the cutters being yieldingly pressed to cutting position, and the depth of the cutter regulated by the adjustment of the guide-wheels on which the machine travels.

RATCHET FOR GRINDING-MACHINES AND FOOT-POWER APPARATUS.—G. W. Riddle, St. Joseph, Mo. The invention relates to devices for use in converting the treadle motion of foot power machines into continuous rotary motion. It is particularly applicable to grinding machines and other foot power apparatus in which a continuous rotary motion is desired for a short space of time, although it may be applied to other devices as well.

Prime Movers and Their Accessories.

CARBURETER.—P. Daniel, Perth Amboy, N. J. One object of this inventor is to provide for the escape of gas from the carbureter in case of back fire, so that the pressure of the exploded charge will not be communicated to the compression chamber. A further object is to provide means for controlling the size of the air passage through the carbureter, and thus to control the explosion charge.

SEDIMENT-REMOVER FOR STEAM-BOILERS. — M. Huffman, care Leslie A. Cranston, Gibson City, Ill. As shown in the accompanying illustration, the sediment remover consists of a steam pipe in the bottom of the boiler, on which is supported a sleeve, provided with deepening scraping knives. By



SEDIMENT REMOVER FOR STEAM BOILERS.

operating a crank, the knives may be drawn back and forth across the bottom of the boiler, loosening the sediment. The steam pipe is perforated at stated intervals, and the sleeve is similarly perforated, so that when the perforations coincide, steam will be forced into the water, agitating the sediment and causing its removal.

Railways and Their Accessories.

AUTOMATIC DUMPING-CAR. — B. L. Worthen, Tucson, Ariz. Mr. Worthen's invention has reference to automatic dumping cars, the more particular purpose being to provide mechanism for keeping the door of the car locked while the car body occupies a normal position, and unlocking the car door whenever the car is tilted into its abnormal position.

STOCK-CAR.—J. C. Jones, Woodson, Texas. The invention relates to stock cars for use on steam and other railways and has reference more particularly to a car for moving cattle, horses and other live stock, and comprising a body having slidably movable side walls which permit the body of the car to be enlarged when desired, the side walls having associated therewith, suitable movable floor sections.

AUTOMATIC BRAKE-ADJUSTER.—J. S. Washburn, Albany, N. Y. The invention simplifies the construction of adjusters of this character and renders them positive in action, the adjuster embodying pawl and ratchet members, with one of last carried by the frame of the truck and the other connected to the brake-lever and arranged to be engaged to the first member and lock the lever in successive positions, the lever being operatively connected at opposite sides of its fulcrum to opposite ends of the brake-rod of the usual brake mechanism. Mr. Washburn has invented another automatic brake-adjuster, a brake appliance for automatically taking up the slack in car brakes, a construction in which both brake beam levers constitute live levers and one provided with adjusting means, each lever being connected to the brake-operating mechanism by a brake rod, with the brake rod of the lever having the adjusting means serving to effect the latter's operation.

Pertaining to Recreation.

ARTIFICIAL BAIT.—G. H. Garrison, Olympia, Wash. This invention pertains to bait of the kind used in fishing, the more particular purpose being to provide a construction of bait having generally the form of a fish or similar animal, and provided with means controllable by the motion of the bait through the water for causing the same to simulate a natural swimming motion.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Legal Notices

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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since October 4th, 1859, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

Notes and Queries.

Kindly write queries on separate sheets when writin about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12317) L. H. says: I have a dynamo which can also be used as a motor. As a dynamo it will produce 6 volts, 6 amperes, if run at a speed of 2,200 revolutions a minute. As a motor, if furnished with a 6-volt, 6-ampere current, will it make 2,200 revolutions per minute? If not, how many? A. If your motor is furnished with the same power as is used in running it as a dynamo, it will turn at the same speed, running free, as when run as a dynamo, less the number of turns per minute lost by the fractional and other resistances, such as I^2R losses. These are subtracted from the current given out by the machine as a dynamo when run at a certain speed, and must be added to the current given to the machine as a motor to produce the original speed, under the same circumstances.

(12318) A. A. says: I take the liberty to ask you a question as to renewing common dry cell batteries. If there is any way to renew them, I would appreciate it if you would tell me how. A. It is possible to get some more work out of a spent dry cell by opening it and filling it with a saturated solution of ammonium chloride, the same as is used in a wet Leclanche cell. Some have punched the case full of holes and set the whole in a glass jar with this solution, thus changing it into a wet cell. In either way something can be done, but you will get only a part of the work a new cell would give.

(12319) E. R. M. says: Will you kindly give me a description of the best method of making a rectangular wooden water tank, say about 4 feet x 4 x 10 feet? A. A tank such as you describe may be made of any sound straight-grained wood, preferably pine or spruce; or cedar may be used if the possible taste imparted to the water is no objection. The planks should be not less than 2 inches thick, and should run longitudinally. Wide planks decrease the number of joints, and we suggest getting 12-inch width if possible. The ends of the tank should be grooved into the sides and bottom, the planks of the ends running horizontally. There should be four 6 x 6 cross beams under the tank, with corresponding uprights on each side of the tank; uprights notched into the cross pieces to prevent the tank from spreading, and the pairs of uprights connected together across the tank, at their upper ends, by ¾-inch iron rods, with nuts on each end. The sides and ends should be held together by half-inch rods, put in holes drilled edgewise through the planks, and secured top and bottom by washers and nuts. The tank therefore consists of four U frames of 6 x 6 timber, the sides of each U connected together by a tie rod, and plank sides and bottom placed inside of the U; the ends being notched into sides and bottom, and thus serving to take the thrust of the two end frames and make all solid. If the tank is kept full of water, it will be found satisfactory over a long period; but if exposed to the weather and allowed to remain empty for long periods, there is no possible way to overcome the shrinking and swelling.

(12320) C. A. C. says: What metals are attracted by quicksilver? A. There are no metals which are attracted by mercury, or quicksilver, as it is often called, as iron is attracted by a magnet. Mercury will wet and adhere to a large number of metals when they are clean, just as water will wet clean glass, and it will dissolve these metals, forming amalgams with them. Tin, gold, silver, lead, and copper are the more common metals to be thus attacked by mercury.

(12321) L. E. B. says: 1. Will a vessel of sufficient size and rigidity, and containing a vacuum, rise in the air? A. A vessel containing no air, that is, with a vacuum within it, will rise in the air if its weight is less than the weight of the same volume of air, or anything less than 1¼ ounces per cubic foot at normal barometer. 2. Is there any record of the principle of the buoyancy of a vacuum in the air having been applied to an airship? A. We cannot say whether anyone has made a balloon from a rigid vessel by pumping the air out of it. It certainly would require a very strong vessel to withstand the enormous air pressure on the outside. It does not seem possible on any large scale.

(12322) G. W. D. says: 1. In a recent issue of the SCIENTIFIC AMERICAN reference was made to the fourth dimension. A. The fourth dimension is not a topic for a note, but is a subject upon which we awarded prizes a while ago for essays. These essays have now been published in book form. price $1.50. 2. Would also like to know what centripetal force is. A. Centripetal force is the force of attraction upon a revolving body to hold it to its center of revolution. It is the attraction of the sun for the planets which revolve around it, or the attraction for the moon exerted upon it by the earth to hold it in its orbit, of which the earth is the center of motion. See any textbook on physics.

NEW BOOKS, ETC.

HANDBUCH FÜR HEER UND FLOTTE. **Enzyklopädie der Kriegswissenschaften und verwandter Gebiete. Herausgegeben von Georg von Alten, Generalleutnant z. D. Unter Mitwirkung von mehr als 200 der bedeutendsten Fachautoritäten. Vollständig in 108 Lieferungen reichillustrierten Textes mit farbigen Beilagen, Karten, Plänen, Gefechtsskizzen usw. Preis jeder Lieferung 2 Mark = K. 2.40. Deutsches Verlagshaus Bong & Co.**

In the new installments of this encyclopedia, we find an excellent discussion of the Germanization of the Polish provinces, a subject which is just now of vast political importance to the thinking German. Another article to which attention should be directed is that on the German empire, which is most carefully written and excellently illustrated. The subject of the kingdom of Denmark is handled in the same thorough way. The Dardanelles, which have played their part in the wars and politics of Europe, are likewise considered in a noteworthy article. Marine affairs are considered in articles on the steamship, the marine turbine, the dreadnought type, three-masted sailing ships, etc. Wireless telegraphy and wireless telephony, and their military importance, are discussed. Among the historical articles may be mentioned that on the German-English Legion. The article on the Danube is a very good history of the river, which has played an important part in the history of Europe. The same may be said of the article on Danzig, the latest of Germany's naval stations.

THE NORTH POLE. **Its Discovery in 1909 Under the Auspices of the Peary Arctic Club. By Robert E. Peary. With an Introduction by Theodore Roosevelt. New York: Frederick A. Stokes Company, 1910. 8vo.; 373 pp. Price, $4.80 net.**

It is not too much to say that this is the most important contribution ever made to the vast literature of polar exploration, because Mr. Peary has actually accomplished what other explorers have vainly essayed to do, and he has returned to us from the Far North in bodily and mental health, so that many of us have been able to hear the wonderful story from his own lips. To say that the book is a fascinating one would fall far short of the mark. It divides with Mr. Roosevelt's own book the laurels of the year. As a piece of bookmaking it appeals at once to the lover of the beautiful. It is excellently made, and is an ornament to any library. This book gives now for the first time, and once for all, the final account of the greatest exploring achievement of centuries. Many books are called unique, this one is so in the full sense of the word. It can have no successors, no competitors. Aside from its intrinsic value the volume has an interest which will distinguish it from all other histories of exploration. The already brilliant magazine articles have been so revised and enlarged as to make an inspiring work, full of the swing and determination of an army's march through a hostile country. It tells of man's work—the triumphant completion of a lifetime of effort—a victory which demanded perseverance, foresight, wisdom, strength, leadership, and loyalty. The 110 illustrations, chosen from about 1,500 negatives, are noteworthy. Eight are in full colors, from photographs treated by the artist who colored the splendid lantern slides used in Commander Peary's lectures. The black-and-white engravings present the typical features of the journey, placing special emphasis on the perilous sledge dash from Cape Columbia to the Pole and back. Many of the most important of them have not been retouched in the least to remove mechanical defects, as they were regarded as more interesting and valuable in their imperfect condition. No layman can gain an intelligent idea of what Peary did without an examination of pictures and text as they appear in book form.

OUR INLAND SEAS; THEIR SHIPPING AND COMMERCE FOR THREE CENTURIES. **By James C. Mills. Chicago: A. G. McClurg & Co., 1910. 12mo.; 380 pp. Price, $1.75 net.**

This book is distinctively a history of shipping on the Great Lakes, and a most fascinating story it makes. Marine development, from its genesis three centuries ago to the present day of immense steel freighters and innumerable fleets, is covered, the perils that ever have and still environ this shipping are told in a thrilling manner, and the building and operation of the present-day freighters, are told in detail. And through the story, with its interesting side lights on history and bizarre tales of lost treasure and lost people, is woven the revelation of the economic value of lake shipping; and in conclusion, there are far-seeing chapters on the possibilities of greater waterway traffic development in the future. The ground covered by the book does not overlap that of any previous publication.

DEATH AND RESURRECTION. **By Gustaf Bjorklund. Chicago: The Open Court Publishing Company, 1910.**

Gustaf Bjorklund was a Swedish scientist who was well known in his own country, but who has been almost entirely ignored in other lands, largely because of the inaccessibility of his writings. The publishers have performed a signal service by presenting in an excellent translation Bjorklund's remarkable book on death and resurrection, for here we find a sympathetic reconstruction of the idea of immortality on the basis of science, almost as important as Fechner's book on life after death. In the organization of the cells in the human body, Bjorklund saw an example of a universal law governing all life. With this thought as a starting point, he undertook to investigate the problem, all-important to his philosophy, of the awakening of self-consciousness in a cell organization, and the relationship between this new-born ego and the cells themselves, each of which, to a certain degree, leads an independent life. This work is undoubtedly one of Sweden's most remarkable and interesting contributions to contemporary philosophy, as well as the last from Gustaf Bjorklund's hand, for he died in July, 1903. Although the philosophical structure that Bjorklund so successfully started to build is far from complete, he at least showed us a road to reconciliation between idealism and natural sciences that for a long time seemed entirely lost in the materialism of the last century.

AMERICAN CORPORATIONS. **By John J. Sullivan, A.M., LL.B. New York: D. Appleton & Co., 1910. 12mo.; 455 pp. Price, $2 net.**

This volume combines a scientific treatment of corporation law with a mass of practical information which must usually be sought through a number of different books. In addition, the subject is handled in an interesting way, so that the casual reader may find entertainment as well as instruction. The twofold purpose has led the author to relegate a quantity of detailed information to the appendices at the end of the book. A number of illustrative cases which have been decided by the highest courts serve to brighten the text, and at the same time explain some of the more difficult principles. Besides, a variety of forms are introduced in appropriate places. Special attention is paid to the rights and powers of companies coming into one State from another, and also to public and semipublic corporations. The book, like all of the others in the series, is excellently made.

SWITZERLAND; ITS SCENERY, HISTORY, AND LITERARY ASSOCIATIONS. **By Oscar Kuhns. New York: Thomas Y. Crowell & Co., 1910. 12mo.; 294 pp. Price, $2 net.**

Works on Switzerland are not numerous except accounts of mountain climbing, and for this reason the book before us will be of special interest. Switzerland is becoming each year more of a center for tourist activity. The book is one of the best that we have seen on the subject. The scenery, history, and literary association of the country are fully set forth. The author leaves no portion untouched, and illustrations from photographs give a clear conception of the principal cities, mountains, and lakes. A description of a trip to the Italian lakes finds an appropriate place in the work. With large map and 32 full-page illustrations.

TRANSACTIONS OF THE AMERICAN CERAMIC SOCIETY. **Columbus, Ohio: Published by the Society, 1910. 8vo.; 880 pp.**

This portly volume contains the papers and discussions read at the Pittsburg Meeting last February, together with some other contributions. The book is filled with matter which will prove of interest to all engaged in the fabrication of ceramics.

ONE HUNDRED MASTERPIECES OF SCULPTURE, FROM THE SIXTH CENTURY B. C. TO THE TIME OF MICHAELANGELO. **With an Introduction by G. F. Hill. John Lane & Company, 1910. 8vo.; 212 pp. Price, $4 net; postage 20 cents extra.**

This is first and last a picture book, but the text which faces the plates is sufficient to carry the engravings. Books of this kind with many illustrations on a liberal scale, are more useful than more scholarly books which are not so well illustrated. The word "masterpieces" is, of course, used in a loose sense, which allows the possibility of more than one to each artist. The introduction occupies 107 pages and is an excellent critical discussion of the whole subject. It is an admirable book, beautifully made.

DIE KULTUR DER KULTURLOSEN. **By Dr. Karl Weule. Stuttgart: Kosmos Gesellschaft der Naturfreunde, 1910.**

In this latest of the little popular monographs published by Kosmos Gesellschaft, Prof. Weule has given us a very succinct and clear statement of recent discoveries relating to prehistoric man.

MODEL GLIDERS, BIRDS, BUTTERFLIES, AND AEROPLANES; HOW TO MAKE AND FLY THEM. **By E. W. Twining. London: Percival Marshall & Co. New York: Spon & Chamberlain, 1910. 12mo.; 13 pp. Loose working drawings and cardboard cut-outs. Price, 50 cents.**

The Gas-Supported Airship.

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same ease as a spherical. It has a comparatively high speed for shorter periods at a time, is capable of ascending and descending far more quickly, or temporarily stemming a brisk wind while attempting a short cut to favorable air currents. Its exceptionally trustworthy power plant consists of two aeroplane motors of 40 horse-power each. This same Parseval Airship Company also builds Wright machines. Two of the new Wright motors will be installed in each one of its small sporting airships in the future. These vessels are to run but seldom under full power. It is easier to carry a powerful motor than an ample supply of fuel. In emergencies, where high speed is invaluable, such as escaping from a squall, or in keeping afloat dynamically when the gas supply is depleted, a powerful motor is of the utmost value. These Parseval ships have only one air ballonet. They are steered up and down by a horizontal rudder, and from side to side by a vertical rudder of the well-known Parseval type.

This Parseval sporting type finds its counterpart in France in the Zodiac vessels, which are like small "Clement-Bayards" with a propeller placed in the rear. A Zodiac cannot be handled as easily as a Parseval. On the other hand, it is claimed for it that the vessel can do without a shed, can be inflated in the open, transported, and deflated as readily as a spherical balloon. To attain that end, the frame is so made that it can be taken apart. Although inflated with ordinary illuminating gas only, a Zodiac can carry two men. It is unfortunate, however, that the motor is rather weak, so that not much speed can be made when necessary.

The largest Parseval type has recently been successfully adapted for passenger traffic. Trips have been made from Munich to the suburbs of Oberammergau. This passenger Parseval has a longer and narrower car, with benches placed along the side, very much as in an American street car. Beneath these handsomely upholstered seats long gasoline tanks are housed, an arrangement which is much more comfortable than that of last year's type. The great length of the car also serves to stiffen the entire structure.

An entirely new Parseval model is about to be completed for the German army. In this vessel radius of action has naturally been sacrificed to high speed. Although the displacement is but 5,000 cubic meters, the engines are much more powerful than those of the 6,700-cubic meter type. Evidently the object of the type is to make the best of the Parseval's easy maneuvering qualities. The new ship is designed to be inflated as close to an enemy as possible. It need never fly far. Hence high speed and immunity from an enemy's fire are the chief objects which have been kept in view.

The tendency of the Zeppelin system, which also has its advocates, even among army men, is radius of action rather than speed. The slender, rigid form of this giant craft is necessarily conducive to high speed with less fuel consumption than in any other system. Thanks to the multiple internal envelopes, which are protected by the frame and outer skin, gas is economized. The recent invention of an anchor which in a few minutes can be prepared to hold the vessel against any storm (arms spread umbrella-like under the ground in a deep hole), and the drilling of the crew in anchoring practice, will probably add to the safety of the rigid Zeppelins. In the future, we may expect to see a Zeppelin, when on the ground, swinging like a weather vane at the end of a short cable fastened to the bow. The anchorage is like that of a true ship of the sea. When the "Zeppelin II." broke away at Limburg, it was found that although the heavy steel cable had been torn, the fastening of the cable to the bow was intact. It is conceded that the officers in charge on this occasion made egregious errors. At Buelzig and at Biberach, Zeppelin ships had ridden at anchor in gales of 50 miles an hour. Slowly and automatically they had swung into the line of the storm. Not once did they show a tendency to bound against the ground. The bow was drawn close to the ground by a short steel cable, and the front horizontal rudders were set at a negative angle, while the stern was floating freely with rudders set at a positive angle. Hence the wind itself could be depended upon to keep the hull safe from any dangerous collision with the ground. Clearly, the front rudders would be pressing the bow down and the rear rudders were raising the stern; yet the vessel could not rise so far as to prevent the wind from striking it on the back and forcing it down violently against the ground. All these ingenious devices were evidently unknown to the men in charge at Limburg, for they made no use whatever of the rudders, and allowed the craft to float horizontally some 20 feet above the ground at the end of the long, slack, front cable, held only by a company of soldiers and many ropes. Lack of concerted action upon the part of the soldiers, upon whom the duty of anchoring the Zeppelin has usually devolved, has probably aroused prejudice against the Zeppelins. One may imagine what would happen to the "Lusitania" if she were docked by unskilled hands. Hudson River men still remember the hours required to dock her safely when she first came over here. The problem of handling a Zeppelin is not nearly so difficult, but requires practice. The ship's own power is far more efficient than any number of men. If there is any wind, the rudders will keep the ship at any desired level on the ground, which was proven at the Echterdingen landing. In a perfect calm there is no need of any muscular force. Where the Zeppelin is really deficient is in her engines, for these have always been more or less untrustworthy. Much depends upon progress in the development of motors. When a truly efficient and reliable engine has been perfected, the Zeppelins will really constitute a formidable aerial navy, capable of cruising hundreds of miles from a home port. It is not insignificant that the English naval authorities should have modeled their dirigible upon the Zeppelin system.

Between the two extremes of airship design marked by the smallest Parseval and the largest Zeppelin, all other types of airships find a place. Their powers and limitations depend to a large extent on their size and the degree of their rigidity. The designs are numerous and varied. Thus, the Italian military dirigible has much framework concealed within the envelope, although the frame itself is flexible. The Wellman-Vaniman "America," as well as the small Ruthenberg dirigible, is nearly as rigid as a Zeppelin, because a stiff frame runs along nearly the entire length of the gas bag close to the envelope. The German Gross-Basenach system is very simple, and is a clear realization of the semi-rigid principle. The high speed of that type is due to the slender shape of the frame and to the cloth covering of the frame. The old Lebaudy type, one of the first really practical dirigibles ever built, seems nowadays rather complex, in comparison. Many planes and appendages which were required in that type, for stabilizing, are now discarded for much simpler devices, which serve the same purpose. The "Clement-Bayard II." has returned to the simplicity of the old "La France," even though at the cost of a vulnerable frame, which may break during a too violent landing. The modern tendency is to develop large sizes and multiple cars. The new Zeppelins have a long inclosed passageway, continued above the cars, and a passenger cabin in the center, in addition to the two familiar cars. The latest Gross-Basenach will have two cars fore and aft. The big, non-rigid Siemens-Schuckert will have three cars. The ultimate tendency, however, is embodied in the Schütte-Lanz, with one closed car of great length. This is to be suspended

from short steel ropes from a rigid keel having a wooden frame, the object being to localize shocks in landing. The necessity of removing the car from the hull, and the wisdom of introducing flexibility into a system that is otherwise made rigid with so much care, may be an open question. If, however, the Schütte-Lanz long single car space is adapted to a new large Zeppelin design, we may arrive at theoretical perfection. The new rigid French Spiess, although smaller than the smallest Zeppelin, embodies this design, as did also Wellman's "America," which, though semi-rigid, had much in common with a rigid ship. The Zeppelin, carrying the propellers on the side of the hull, also lends itself best to multiplication of the motors. Weight may thus be evenly distributed over the entire structure, thus eliminating much useless strain. Many motors are also a tendency of the day. The two latest Gross-Basenach, Siemens-Schuckert, Schütte-Lanz, carry four motors each, while the latest Zeppelins have three.

That the Zeppelin disasters are largely due to carelessness and downright hard luck, is forcibly illustrated by the fate of the last one, which succumbed to an explosion of gasoline in the car. At least one Blériot monoplane and many automobiles have been similarly destroyed. Fortunately, this last accident to a Zeppelin gave rise to but little criticism of the system as a whole. It was too obviously due to extraneous causes. Besides, there had been many daily successful passenger trips by this same ship, long before the accident occurred. When the vessel exploded, a new "Deutschland" was almost completed, and there were orders on the books for new passenger ships for the Hamburg, Berlin, and Baden-Baden stations.

It is fairly well conceded now that only the largest airships can compete with aeroplanes, for large vessels alone can command moderate aeroplane speed (proved by the approximately forty miles an hour maintained by the "Deutschland"), a superior radius of action, and the capacity for carrying passengers quite beyond the reach of heavier-than-air machines. As with railroad trains and ships on the water, economy of operation increases in the same degree, and for very similar reasons, directly with the size.

THE INTERNATIONAL AVIATION MEET.

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of several thousand people who had arrived early. After making 13 laps, Mr. Ogilvie was obliged to descend at the eastern end of the track on account of a faulty spark plug. This did not put him out of the race, however, as the conditions allowed of as many stops as might be necessary without penalization. After a delay of 59 minutes and 50 seconds, Ogilvie resumed his flight and finished without further trouble in 2 hours, 6 minutes, 36.39 seconds total elapsed time. His actual time in flight was 1 hour, 6 minutes, 46.69 seconds, which corresponds to an average speed of 55.83 miles an hour.

Grahame-White completed his 20 laps without a hitch, and finished in 1 hour, 1 minute, 4¾ seconds after his starting time. He had made an average speed of 61 miles an hour; but it seemed practically certain that Leblanc would beat him badly, as the Frenchman was driving his 100-horse-power Blériot with consummate skill and at tremendous speed. He hugged the pylons closely, and gained steadily upon White during all the time the latter was flying. He completed 19 circuits of the course in 52 minutes, 49.79 seconds, which meant an average speed of 67 miles an hour. He was almost half way around the course on his last lap when his machine dove to the ground and struck a telegraph pole squarely in the middle. A section was cut out of the pole, and the machine was whirled about. Leblanc was thrown out, but was not seriously injured, the accident in this respect resembling those that frequently happen in automobile races, where the machine swerves and goes through the fence. The daring French aviator was cut about his face, but no bones were broken. The body of his machine was broken a short distance back of the wings, and one blade of the propeller was gone (as can be seen from the photograph reproduced herewith), but otherwise the machine was not seriously damaged, although it cut out a section of the pole (which is seen lying in front of it in the photograph) about five feet in length. The bottom cross member of the frame of the monoplane cut fully half way through the pole, and is seen imbedded in it. While not as spectacular as the accident to Blériot at Rheims last year, in which his monoplane caught fire while flying, dove to the ground, and was demolished, Leblanc's accident demonstrated the great momentum of a comparatively light aeroplane when traveling at express-train speed, and again showed the safety of the monoplane in the event of a head-on collision.

As the weather had been too windy for the holding of an elimination race, the officials selected an American team two days before the international race. The team consisted of Walter Brookins, with the tiny Wright biplane racer illustrated in our last issue; Charles K. Hamilton, with his Curtiss-type racer fitted with a 115-horse-power Christie 8-cylinder, V-type motor; and Mr. J. Armstrong Drexel with a 50-horse-power racing Blériot monoplane. America's chief hope was centered in the tiny Wright biplane of but 20 feet spread, and about 130 square feet supporting surface. This machine, fitted with an 8-cylinder, V-type Wright motor of 60 horse-power, had exhibited great speed capabilities when driven by Orville Wright, but Brookins had never flown it around the course. When he finally started in the race in the middle of the forenoon, he crossed the starting line at terrific speed. He had gone but a few hundred yards when the machine dropped to the ground, made a couple of bounces after striking hard on its front wheels and skids, and then turned a complete somersault. Brookins tumbled out at the first shock, and rolled head over heels along the ground before the aeroplane turned over. As the machine is estimated by the Wright brothers to have been traveling fully 80 miles an hour at the time, the young aviator's escape from death was truly marvelous. No bones were broken, and save for scratches and bruises, Brookins was unhurt. The machine was damaged considerably, though by no means beyond repair. With the destroying of the Wright racer almost before it had started in the race, the chances of America's winning seemed decidedly slim. Mr. Drexel started late in the afternoon and made seven laps, after which he abandoned the race, chiefly on account of the wind, which had reached a velocity of over 20 miles an hour. Radley, who represented England in a Blériot monoplane, did not start on this account. Hamilton had difficulty in starting his motor, and did not succeed in making a start until half a minute after the last bomb was fired, which was at 3:32 P. M. He made half a circuit of the course, but was obliged to descend on account of a leaky water pump. John B. Moisant, who was one of the alternates on the American team, entered for the race a few minutes before this time, and succeeded in crossing the starting line less than half a minute before the time was up. He made six laps in 23 minutes, 26 4/5 seconds, finally alighting at the east end of the track after making a wide circle over the grand stand. At 4.34½, after a delay of about three-quarters of an hour, he started a second time, and completed 14 more laps. His total elapsed time was 1 hour, 57 minutes, 44.85 seconds. Mr. Moisant exhibited true sportsmanship in entering the race at the last minute, and completing his 20 laps. By so doing, he

won second place for America.

France's second representative was Hubert Latham, in his 100-horse-power, 16-cylinder Antoinette monoplane. Latham started early in the forenoon, and completed 15 laps without a stop. Just as he was finishing his fifteenth lap, he experienced difficulty in controlling his monoplane, but managed to alight safely in the center of the field. At 4:29 P. M. he ascended again and completed the race, his total elapsed time for the 62 miles being 5:47:53.40.

The results of the international race have justified our prediction that a monoplane would win. America lost this race through unpreparedness, and had ill-luck not overtaken Leblanc at the eleventh hour in the breaking of his gasoline feed pipe, the race would have been won by a Frenchman in a French monoplane. As it is, a French monoplane, driven by a skilled English pilot, has carried off the trophy. Had America's chief representative not experienced slight motor trouble at the start, there is also little doubt but that the Wrights would have made an excellent showing with their tiny and extremely fast biplane racer. An air pocket in the gasoline feed supply to one of the sets of four cylinders in the new 8-cylinder motor was the probable cause of the momentary stopping of the four cylinders, which resulted in a smash-up. Thus it will be seen that the failure of the fuel to feed was the cause of the accident to both the leading French and American aeroplanes. In the case of Leblanc, an investigation after his descent showed that he had swept four or five hundred feet off the course before descending. As he hugged the pylons closely throughout the race, it would appear as though something went wrong with his machine, and that the failure of the gasoline to feed was not the real cause of his disaster.

It may seem remarkable that two similar machines having the same horse-power, weight, and surface should show such a considerable difference in speed when driven by two different, though equally skillful pilots. The difference between the best laps of Grahame-White and of Leblanc was 11.45 seconds, while the difference between the slowest laps of these two aviators was about 25½ seconds. Had Leblanc finished the race at the speed he was making, he would have completed his 20 laps in 55 minutes and 35 seconds, as against 61 minutes, 4.74 seconds scored by Grahame-White. The previous best record for 100 kilometers was made by Morane at Bordeaux, France, during the past summer in a 50-horse-power Blériot monoplane. His time was 1 hour, 6 minutes, 39 4/5 seconds, which is equivalent to 55.92 miles an hour. Grahame-White attributed the difference in speed between his machine and Leblanc's to the propeller. The propeller on his machine, he claimed, did not have as great a pitch as that on the Leblanc monoplane. Leblanc's fastest lap was his last one, which was made in 2 minutes, 44.32 seconds—a speed of 71.68 miles an hour. White's best lap was his fourteenth, which was covered in 2 minutes, 55.77 seconds—a speed of 66.26 miles an hour.

The only other special contests of Saturday were the hourly altitude contests, both of which were won by Hoxsey, with 5,146 feet and 4,644 feet, respectively, to his credit. Johnstone was second in each contest, with 3,235 and 4,091 feet as his score.

Sunday, October 30th.—The last day of the meet, as far as the regular programme was concerned, was given over chiefly to the making of the Statue of Liberty flight by the various aviators. This contest had originally been intended for Thursday, October 27th, but it was extended and was declared open during any day while the meet lasted. On account of a misunderstanding, several of the aviators did not compete on Sunday, as they believed that owing to the extending of the meet one day, they would still have a chance on Monday. The first aviator to make the flight was Mr. White, who started in his 100-horse-power Blériot shortly after 3 o'clock. He was followed a few minutes later by Count de Lesseps in a 50-horse-power Blériot monoplane. Grahame-White flew by way of Coney Island, and Count de Lesseps followed the railroad part of the way, and then flew around Manhattan Island. Both aviators reached a height of some 2,500 feet, so as to be safe in passing over the city. They made the flight and returned to Belmont Park in 35 minutes, 21.3 seconds, and 39 minutes, 38.5 seconds, respectively, and it was thought that the Englishman was the winner. A quarter of an hour after he finished, however, John B. Moisant appeared at the starting line in Leblanc's 50-horse-power Blériot, which he had just purchased from the French aviator after smashing his own machine by colliding with Harmon's biplane early in the afternoon. After making one circuit of the field, Moisant, flying by compass, headed straight for the Statue, and rose rapidly against the slight breeze to a height of 2,800 feet. He made the turn above the Statue of Liberty, and came back to the park over as straight a course as he had steered on his outward trip. His time to the Statue was somewhat less than the times of either White or Count de Lesseps, and when he was due to arrive at Belmont Park and his margin for winning the race decreased to one minute, the excitement of the crowd was very great. He succeeded in swooping down and crossing the line in 42¾ seconds better time than that made by Grahame-White, so that he was hailed the victor of the most thrilling cross-country race New Yorkers have ever had a chance to witness. The cash prize won by Moisant in this event was $10,000, which was put up by Mr. Thomas F. Ryan. The other flights of the afternoon were made by five Blériot monoplanes, while Latham attained a height of 3,395 feet in his Antoinette monoplane. No Wright machines made flights on this day. Charles F. Willard and Capt. Baldwin made a few turns of the course, and at the close of the day Glenn H. Curtiss made a short flight in his new monoplane. Grahame-White won the elimination race for monoplanes and Radley and Aubrun each made 20-mile cross-country flights successfully.

Monday, October 31st.—The chief events of the last day were the great 10-lap speed race between biplanes and monoplanes, the altitude duel of Johnstone and Drexel in their Wright and Blériot machines, and a special 2-hour distance race for prizes of $2,000, $1,000, and $500 offered by the Aero Club. The distance race lasted the greater part of the afternoon, and resulted in another victory for Mr. Moisant. His 50-horse-power Blériot made 58 laps of the short course (88⅓ miles) in the 2 hours, and this despite the fact that he was flagged once and made to stop upon Simon's protest of fouling. He was penalized 3 laps and lost 14 minutes. Simon and Latham had engine trouble and were obliged to stop twice and thrice respectively. Latham obtained second place with 35 laps (54 1/3 miles), and Simon third, with 24 (37¼ miles). The altitude flights were made in the middle of the afternoon, and a new world's record was set up by Johnstone, who, using one of the new small Wright biplanes, succeeded in reaching the height of 9,714 feet—548 feet higher than the record of Wynmalen in his Farman biplane, made early in October in France. Mr. Drexel also made a monoplane record of 8,373 feet. Grahame-White, in his Blériot, beat McCurdy, in his Curtiss, badly in the 10-lap speed race between monoplanes and biplanes. White's time

was 14:34.4. His monoplane turned a somersault when alighting, but without injury to its pilot. The Englishman won a $3,000 prize and McCurdy a prize of $1,000. Besides this speed race, the afternoon was given up to exhibition flights by various aviators.

The winners in the totalization of duration and totalization of distance contests for the meet proper, which closed Sunday night, were as follows:

TOTALIZATION OF DURATION.

Aviator.	Time.	Prize.
Hoxsey	6:29:21.85	$3,000
Latham	5:09:29.59	1,500
Grahame-White	4:57:01.08	1,000
Johnstone	4:47:44.40	500

TOTALIZATION OF DISTANCE.

Aviator.	Laps.	Prize.
Latham	108	$1,500
Grahame-White	107	1,000
Aubrun	59	500

This meet was the first real international aviation meet to be held in the United States, and while there were some disputes among aviators as to the way it was conducted, on the whole it was carried out to the satisfaction of the public. The demonstrations of speed, high flying, and duration were all that could be desired. At some times during the meet, as many as fourteen machines were in the air simultaneously—a spectacle that two years ago one would not have expected to see for five years to come at least. In all probability, no such combined demonstrations of flight will be seen in this country again until another international meet is held in the vicinity of New York next year.

THE WORLD'S GREATEST SHIP.

(*Concluded from page 380.*)

"City of Paris" and the "City of New York" were steady and very much along the same lines. The "Lucania," the "Kaiser Wilhelm der Grosse," the "Deutschland," etc., were built in more or less rapid succession, and exceeded their predecessors in size and in speed.

With the building of the "Lusitania" and the "Mauretania," turbine engines permanently entered the field of transatlantic navigation, although the two Cunarders were not by any means the first vessels in which the turbine was installed. In the "Mauretania" and "Lusitania" a speed of from 25 to 26 knots is maintained steadily, but at a cost which might well give less wealthy owners pause. The White Star Line has made no effort to compete with other companies in building ships which will hold transatlantic records for speed. The "Olympic," like her predecessors, the "Celtic," "Oceanic," and "Baltic," is a comfortable ship of moderate speed, as speeds go nowadays. In the combination of reciprocating engines and turbines she represents the entrance of a new type whose performances will be watched with not a little interest.

The Use of the Balloon in Warfare.

It was in the wars of the French Revolution, during the hard-fought battles about Fleurus or Fleury in Belgium, that the French for the first time made use of the balloon in warfare. By its means they reconnoitered, recognized the comparative weakness of the enemy, and were thus enabled to take the measures resulting ultimately in their remaining in possession of the field of battle, thus achieving a victory. This occurred on the 26th day of June, 1794. The battle had lasted ten days, having been begun on June 16th. The French had made many unsuccessful efforts to cross the river Sambre and gain a footing on its left shore. Finally the "Commissioners of the Convent," representing the government, and accompanying the French armies as was then the custom, "for reasons of state," made Gen. Jourdan commander-in-chief over the united French forces, amounting to some 105,000 men—thus enabling him to bring order out of chaos. He at once reorganized the forces under his command, and brought about the unity of action that culminated in the victory mentioned.

Crossing the Sambre on the 12th of June, the French general so disposed his troops about Charleroi that the allies under the Hereditary Prince of Orange, in order to relieve this fortress, began an attack upon his forces on the 16th of June; and receiving reinforcements under Prince Frederick Josias of Coburg, they were on the point of achieving a signal victory at the end of ten days of hard fighting. But, probably too confident, "the allies neglected to properly reconnoiter, and thus were in ignorance of the possible resistance the enemy could offer," as the old chronicle has it, "whilst the French upon this occasion, for the first time, made use of the balloon for reconnoitering, and convinced themselves of the weakness of the allied forces opposing them," and were thus enabled to convert a threatened defeat into a victory.

Many of the men who later became Napoleon's greatest generals were present at this engagement, and took part in it; we read among the names of the commanders the names of Jourdan, Kleber, Pichegru, Montaigu, Lefèbvre, Marceau, and others.

It is a matter of some surprise that in view of the success attending the use of the balloon on this occasion, its general use in warfare was not by them introduced and recommended to Napoleon, their chieftain. He surely would have been interested, could he but have known that over these selfsame fields that so nearly proved fatal to the destinies of France then, there would be fought, but twenty-one short years later to the very day, the battle of nations that closed his glorious career; for it was in the middle of another month of June, from the 16th to the 18th day of the month, that there took place here, in the year 1815, the battle of Waterloo.

Big Guns and the Wireless Telegraph.

It has been demonstrated that the wireless telegraph apparatus as used by our battle fleet has been seriously impaired by the extreme heavy firing of the large guns during the recent battle practice of the Atlantic fleet off the Virginia coast.

Reports to the effect that some of the apparatus was of such a delicate nature that it had been put out of gear on one of the ships after five minutes of big-gun work, and had not responded to the efforts of the wiremen to readjust it for several hours afterward are apt to cause many new experiments to be made to determine a relief from the conditions which now exist.

The Navy Department is working on a plan providing some method of meeting the handicap of the exposure of the antennæ to the shots of the enemy, and eliminate as much as possible the exposure of the present high mast. It is planned to build a small portable wireless set, which, while good for short distances, would cut down the distance efficiency, for the high mast is most vital to the sending of long messages. It is also planned to carry a small mast for quick use in emergencies.

Under the rules of battle practice which have been conducted by the commander-in-chief of the Atlantic fleet, considerable trouble was experienced in view of the heavy seas that interfered with the work of the sixteen battleships, and the fact that the flagship and the vessels of the firing squadron had to be in communication by wireless all the time.

It has been planned that regular reports will be made to the department on the observations of the workings of the apparatus. It is also thought that the finding of these defects at this time under the heavy strain of the big firing as has occurred is fortunate rather than otherwise, for it places the government in possession of knowledge of the obstacles which the experts all along the line may now work to overcome, thereby making the wireless one of the vital features of naval efficiency as reliable as possible.